WESTERN STATES
DRILLING AND BLASTING, INC.

Providing Drilling and Blasting Services for:

- Residential Development
- Commercial Development
- Mining
- Quarries
- Site Preparation
- Public Works
- Road and Highway Construction

www.wsdbblasts.com

WESTERN STATES DRILLING AND BLASTING, INC.

Introduction

Western States Drilling and Blasting, Inc. and its sister company, Sanders Construction, Inc. are the premiere drilling and blasting companies in the southwestern United States.

Western States Drilling and Blasting, Inc. provides drilling and blasting services for residential and commercial development, site preparation, mine, quarries, public works projects, and road and highway projects.

Under the leadership and direction of Daniel M. Sanders, President and Owner, Western States Drilling and Blasting, Inc. has expanded its operating area from Utah (where it's incorporated) to include Arizona, Idaho, New Mexico, Texas and Wyoming.

Western States Drilling and Blasting, Inc. is committed to remaining the best choice for safe, effective and expeditious drilling and blasting operations throughout the western United States.

WESTERN STATES DRILLING AND BLASTING, INC.

History

Western States Drilling and Blasting, Inc.'s beginning starts back in 1970 with its sister company, Sanders Construction, Inc. (SCI). Verl and Margaret Sanders founded SCI in December 1970. Verl had worked for another construction company performing the duties of drilling and blasting. When the company was unable to complete their existing contracts, Verl took them over and in December 1970 incorporated SCI in the State of Nevada.

Initially, SCI was a one man, one drill operation with Verl's wife, Margaret , maintaining the books for the company. By 1979, when Verl passed away, the company had two drills and was working on several contracts. Verl's son, Daniel, as a teenager had worked with his father learning the drilling and blasting process from the ground up. Upon his father's death, Danny joined the company full-time and took over the role of President.

During the 1980's Danny expanded the company from less than $100,000 per year to several millions.

In 1985, Western States Drilling and Blasting, Inc. was formed to provide drilling and blasting services in Utah. Western States Drilling and Blasting, Inc. later expanded operations to include Arizona, Idaho, New Mexico, Texas and Wyoming.

Western States Drilling and Blasting has performed drilling and blasting services for a variety of projects during the past 20 years. Some of the most notable projects include:

MASTER PLANNED COMMUNITIES/HOUSING DEVELOPMENT

- Sonoran Mountain Ranch – Peoria, AZ.
- Gold Mountain Preserve – Phoenix, AZ.
- Coral Canyon – Washington, UT.
- Stone Cliff – St. George, UT.

MINES AND QUARRIES

- Bagdad Copper Mine – Bagdad, AZ.
- Black Rock Mine – Black Rock, AZ.
- Granite Canyon Quarry – Cheyenne, WY.
- Boars Tusck Quarry – El Paso, TX.
- Comstock Mine – Cedar City, UT.
- Twin Mountain Quarry – Milford, UT.
- Beck Street Quarry – Salt Lake City, UT.

- Red Mountain Mining – Mineral Park, AZ.
- Gray Mountain Quarry – Flagstaff, AZ.
- Mountain Lion Mine – Cedar City, UT.
- Harold's Pit – Clines Corner, NM.
- Tip Top Mine – Cedar City, UT.
- The Burke Mine – Cedar City, UT.
- Equatorial Mineral Park – Kingman, AZ.
- Pedernal Quarry – Cline's Corner, AZ.

GOLF COURSES

- Coral Canyon Golf Course – Washington, UT.

ROAD AND HIGHWAY

- Hoover Dam Bypass – AZ. Approach – Hoover Dam, AZ.
- Lake Pleasant Roads – Lake Pleasant, AZ.
- Provo Canyon Widening, Provo, UT.
- Squaw Peak Highway – Phoenix, AZ.
- Cordes Junction – Cordes Junction, AZ.
- Highway 9 – Hurricane, UT.

CORPORATE OFFICE

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  - 702.558.3563

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  - www.wsdbblasts.com

WESTERN STATES
DRILLING AND BLASTING, INC.

WORKPLACE SAFETY PROGRAM

Policy Statement

Western States Drilling & Blasting, Inc. (WSDB) is committed to providing safe and healthy working environments. Company management continually evaluates the workplace and operations, eliminates hazards, has developed training programs and safe operational procedures, and provides personal protective equipment to reduce the potential for employee exposure to hazardous conditions that cannot be completely eliminated.

Our Workplace Safety Program satisfies the requirements of Chapter 296-52 of The Washington Administrative Code. The program addresses our joint concerns for safety, the prevention of workplace accidents, and explains our individual responsibilities. It demonstrates our understanding that safety in the workplace requires an organized and ongoing management and employee team approach to be successful.

We are personally committed to the implementation and maintenance of the Workplace Safety Program and encourage all of our employees to participate, follow the procedures, and comply with the rules and to think safety and work safely.

Sincerely,

Daniel M. Sanders
President

WORKPLACE SAFETY PROGRAM

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RESPONSIBILITIES AND ACCOUNTABILITY

The following are a list of job titles and the responsibilities associated with them:

SAFETY DIRECTOR

The Safety Director is responsible and shall be held accountable for the implementation and maintenance of this program in his assigned work area. He will:

1. Oversees the safety and health program activity and effectiveness to determine the need for additional programs or revisions.

2. Develops and executes safety policies and procedures.

3. Arranges the allocation of resources to support safety and health program activities.

4. Chairs the safety committee, review accident reports and ensures safety committee meeting minutes are maintained.

5. Ensures new hires are provided an opportunity to read the safety and health programs.

6. Secures and maintains employee safety training documentation and related records.

7. Coordinates safety and health inspection activity, conducts periodic inspection of construction sites and assists superintendents and foremen in correcting hazards which are identified during inspections or investigations.

SUPERINTENDENT

The Superintendent is responsible and shall be held accountable for the implementation and maintenance of this program in his assigned work area. He will:

1. Ensures foremen are providing new hires with job specific safety training.

2. Ensures safety and health training documents are forwarded to the Safety Director upon the employee's initial assignment to work.

3. Ensures that accidents which require investigation (as stipulated in Accident Investigation Procedures section) are conducted by the foremen and that reports generated are submitted to the Safety Director.

4. Assists in the elimination of hazards, which are identified as a result of safety inspections, accident investigations or employee complaints.

5. Conducts periodic safety meetings to maintain foremen and employees are up-to-date on relevant workplace safety matters.

6. Is receptive and open to employee concerns regarding safety and health in the workplace.

7. Disciplines foremen in accordance with the prescribed procedure when they violate safety rules.

FOREMAN

The Foreman is responsible and shall be held accountable for the implementation and maintenance of this program in his assigned work area. He will:

1. Encourages employees to follow safe work practices by setting a good example, and by being receptive to employee safety concerns.

2. Provides specific training and information to newly hired employees regarding safe work practices, personal protective equipment requirements and reporting procedures.

3. Ensures employee training is completed prior to initial work assignment, and that all training documents are submitted to the Safety Director, upon completion.

4. Conducts informal, daily inspections of assigned areas to ensure compliance with company safety rules, eliminate hazards, and to ensure employees are utilizing safe work practices and protective equipment.

5. Conducts accident investigations (as stipulated in Accident Investigation Procedures section) and submits reports to the Safety Director, immediately, upon completion.

6. Conducts periodic tailgate safety meetings and ensures materials, tools and any equipment defects are reported and corrected.

7. Disciplines employees in accordance with prescribed procedures when they violate safety rules.

DRILLER

The Driller is responsible and shall be held accountable for the implementation and maintenance of this program in his assigned work area. He will have:

1. Understanding of proper adjustment to feed pressure

2. Understanding of proper operation of down hole, hydraulic, and air-hammer

3. Understanding of proper rotation speed for various materials, bits, and hammers

4. Understanding of the ability to make speed and pull force adjustments
5. Understanding of adjustments to drill steel angle
6. Understanding of proper air pressures
7. Understanding of proper hydraulic pressure
8. Understanding of how to add additional drill rod
9. Understanding of auxiliary equipment operation, maintenance and cleaning.
10. Drilling techniques
11. Equipment operation, maintenance (minor), cleaning

The Driller also has responsibility over and training in how to address the following items:

1. Visually inspects equipment and reports faults and makes equipment available for routine operational servicing
2. Completes Drill Log (See Appendix A)
3. Identify defective holes caused by unusual drilling conditions such as loss of circulation air, change of material, voids, or detectable seams. Driller will record such conditions on the drill log.
    a. Loss of circulation air can be identified when cuttings stop blowing out of the top of the hole.
    b. Change of material can be identified by changes in color, texture, type of material, or hardness.
    c. Voids can be identified by a loss of circulation air or a sudden fall of the drill bit into the void while drilling.
    d. Detectable seams can be identified when a loss of circulation air occurs or a sudden fall of the drill bit into the void while drilling.
    e. Marks defective drill holes (where applicable) on drill log and circle hole with paint
        I. Drill log will be turned in to superintendent.

BLASTER

The Blaster in Charge is responsible and shall be held accountable for the implementation and maintenance of this program in their assigned work area. The Blaster in Charge will comply with all requirements indicated in Chapter 296-52 of the Washington Administrative Code. They will:

1. Have complete control of all blasting operations and ensure that all persons and equipment are in the clear before firing the blast. Should there be questions regarding blasting safety, they will confer with their immediate supervisor.

2. Ensure that all employees under their control follow safe work practices by setting a good example, and by being receptive to other employee safety concerns.

3. Will be responsible to ensure that all personnel working with explosives material are trained in the storage, transportation, handling and use of explosives and that they have been trained in personal protective equipment requirements and reporting procedures.

4. Ensure that all employee training is completed properly and that all training documents are submitted to the blasting manager.

5. Be able to safely perform the type of blasting to be used as stipulated in W.A.C 296-52-64020

6. Conduct daily inspection activities of their assigned work area, to ensure compliance with safety rules, to eliminate hazards and to ensure employees are utilizing safe work practices and personal protective equipment, and be able to recognize hazardous conditions as stipulated in W.A.C 296-52-64020

7. Conduct accident/incident investigation (as stipulated in the Accident Investigation Procedures section) in conjunction with the Superintendent, Foreman and Safety Director.

8. Conduct weekly safety meetings and ensure materials, tools and any equipment defects are reported and corrected.

9. Will make recommendations to management for disciplinary action of employees in accordance with the prescribed procedures when they violate safety rules.

10. Will be in good physical condition as stipulated in W.A.C 296-52-64020

11. Will not use illegal drugs (including narcotics and intoxicants) as stipulated in W.A.C. 296-52-64020

12. Will have a working knowledge of state and local explosives laws and regulations as stipulated in W.A.C 296-52-64020

13. Will have adequate blaster training, experience and knowledge as stipulated in W.A.C 296-52-64020

14. Will have the ability to understand and give written and oral instructions as stipulated in W.A.C 296-52-64020

ALL OTHER EMPLOYEES

All other employees are responsible and shall be held accountable for the implementation and maintenance of this program. They will:

1. Follow company safety rules and reporting procedures.

2. Report all accidents and injuries to their foreman or superintendent and complete the necessary forms.

3. Communicate concerns for job safety to their foreman, superintendent, or safety committee representative.

4. Utilize provided personal protective equipment.

5. Attend scheduled safety meetings.

6. Cooperate during accident investigations, area safety inspections and training to minimize the risk of work related injuries and illnesses.

7. Conduct daily inspections of their work areas and report unsafe conditions or equipment to their foreman or superintendent.

ACCIDENTS AND INJURIES

EMPLOYEE REPORTING OF ON-THE-JOB INJURIES

Employees must report every on the job injury immediately, regardless of how minor it may seem. This includes bumps, cuts, scratches, or sprains, etc. All reported injuries require the employee complete an injury report. The physician or medical facility will require the employee to complete their portion of the injury report.

ACCIDENT INVESTIGATION PROCEDURES

When accidents involving employee injuries are reported, the immediate concern is providing appropriate first-aid and medical attention.

When accidents/incidents involving employee injury, property damage, or damage to personal property used in connection with company activities occur, they will be reported immediately to the Superintendent, Foreman and the Director of Safety (or his representative) as soon as possible, regardless of the hour.

The accident area must be secured to prevent any further employee exposure. The area will remain secured until such time as the accident investigation is complete and any hazardous condition present at the time of the occurrence is eliminated.

All accidents involving employee injuries will be investigated by the injured employee's immediate supervisor. The foreman will ensure that the employee has taken the appropriate first-aid measures when the injury is minor. The foreman will ensure the employee completes a SIIS C-l Form, and submits it to the Safety Director.

Accidents involving employee injuries that require immediate medical attention (more than simple first-aid) must be immediately reported to the Safety Director. The following procedures will be strictly adhered to:

1. The superintendent will seek immediate medical attention for the victim.

2. The foreman or superintendent will immediately secure the accident area to ensure that other employees are not exposed to hazards related or responsible for the injury.

3. The foreman or superintendent will investigate the accident and complete an Accident Investigation Form.

4. The Safety Director will assist the foreman or superintendent in correcting hazards that contributed to the employee injury.

5. The superintendent will ensure that the completed Accident Investigation Form and a copy of the SITS C-I Form are promptly submitted to the Safety Director.

The primary purpose of the accident investigation is to identify hazardous conditions, what inappropriate or unsafe practices occurred, and to determine what preventative measures could be taken to eliminate or reduce the potential for future injuries similar to the one under investigation.

When an employee requires/receives medical attention as a result of a workplace injury, an Injury Report Form must be completed by the Safety Director. Information obtained during the accident investigation (Accident Investigation Form), is essential to the preparation and initiation of a workman's compensation claim.

The Safety Director will prepare a summary report for quarterly presentation during safety committee meetings. Safety committee members will review this information and assist in recommending suitable corrective measures for which have not been previously or adequately addressed.

RECORDING AND REPORTING ACCIDENTS

The Safety Director will maintain logs and report accidents and injuries. This includes OSHA Form 300 (Log of Work-Related Injuries and Illnesses), OSI-IA Form 301 (Injury and Illness Incident Report) and OSHA Form 300A (Summary of Work-Related Injuries and Illnesses). Work-related injuries and illnesses shall be recorded if they result in one of the following: death; one or more days away from work; restricted work or transfer to another job; medical treatment beyond first aid; loss of consciousness; or diagnosis of a significant injury/illness by a physician or other licensed healthcare professional. First aid treatment is limited to the following procedures and all other procedures qualify as medical treatment beyond first aid and require recording.

1. Using a non-prescription medication at nonprescription strength (for medications available in both prescription and non-prescription form, a recommendation by a physician or other licensed health care professional to use a non-prescription medication at prescription strength is considered medical treatment for recordkeeping purposes);

2. Administering tetanus immunizations (other immunizations, such as Hepatitis B vaccine or rabies vaccine, are considered medical treatment);

3. Cleaning, flushing or soaking wounds on the surface of the skin

4. Using wound coverings such as bandages, Band-Aids™, gauze pads, etc.; or using butterfly bandages or Steri-Strips™ (other wound closing devices such as sutures, staples, etc., are considered medical treatment);

5. Using hot or cold therapy;

6. Using any non-rigid means of support, such as elastic bandages, wraps, non-rigid back belts, etc. (devices with rigid stays or other systems designed to immobilize parts of the body are considered medical treatment for recordkeeping purposes);

7. Using temporary immobilization devices while transporting an accident victim (e.g., splints, slings, neck collars, back boards, etc.).

8. Drilling of a fingernail or toenail to relieve pressure, or draining fluid from a blister;

9. Using eye patches;

10. Removing foreign bodies from the eye using only irrigation or a cotton swab;

11. Removing splinters or foreign material from areas other than the eye by irrigation, tweezers, cotton swabs or other simple means;

12. Using finger guards;

13. Using massages (physical therapy or chiropractic treatment are considered medical treatment for recordkeeping purposes); or

14. Drinking fluids for relief of heat stress.

The Safety Director will complete OSHA Form 300 (Log of Work-Related Injuries and Illnesses), 051-IA Form 301 (Injury and Illness Incident Report) within seven days of receiving information that a recordable illness or injury has occurred.

The Safety Director will post a copy of OSHA Form 300A (Summary of Work-Related Injuries and Illnesses) in a conspicuous place or places where notices to employees are customarily posted. The summary will be posted no later than February 1 of the year following the year covered by the records and the posting will be kept in place until April 30. The OSHA 300 Log, the OSHA 300A annual summary, and the OSHA 301 Incident Report forms will be maintained for five (5) years following the end of the calendar year that these records cover.

HAZARD IDENTIFICATION AND CONTROL

Superintendents, *foremen* and *other employees* will conduct daily, informal inspection activity to ensure that recognized hazards are reported and eliminated. Hazard work order procedures have been developed to facilitate the correction of identified hazards. This procedure prioritizes maintenance activity request for the correction of unsafe conditions. When submitted properly, this procedure will expeditiously eliminate hazards. Hazards that we are unable to immediately correct require the completion and submission of a Hazard Work Order form. Copies of the form are submitted to the Safety Director.

The *Safety Director* will conduct periodic, unscheduled and randomly selected safety inspections to maintain appropriate safety and health program oversight.

When unsafe conditions or practices are identified, the process or task will be discontinued until corrective measures have been taken or interim measures can be employed to prevent employee exposure.

Employees are encouraged to report unsafe conditions or work practices to their foreman or superintendent immediately. and WSDB will not retaliate against any employee for reporting hazards or potential hazards or for making suggestions related to safety in the workplace.

GENERAL SAFETY RULES

The following safety rules have been developed to ensure that common workplace hazards are eliminated. Management and employees alike are expected to comply with these rules and will be disciplined accordingly for failure to do so.

1. Report unsafe conditions/operations to the foreman or superintendent immediately.

2. Compressed air shall not be directed toward any person or utilized to blow dust and dirt from clothing.

3. All work areas, common areas and storage areas are to be kept clean and orderly.

4. Submit to drug/alcohol testing in accordance with and as required by our drug/alcohol policy.

5. An anti-whip device must securely fasten all pneumatic hose connections. Bleed any air hoses prior to attempting to disconnect them.

6. Personal protective equipment must be utilized when the potential for hazards are presented by the work being performed or the work environment (Hard hat, safety glasses, steel toed boots, etc.).

7. Damaged flexible extension cords will not be used. (Grounding pins broken, strain relief pulled, damaged insulation, spliced.)

8. Use proper lifting techniques when lifting any heavy object (maintain back straight and erect, position object lifted directly in front and in close proximity to your body, ensure firm grasp and utilize legs to perform the lift).

9. No hand-held pneumatic or other power tool shall be used without its guard in place and functioning properly.

10. Employees must familiarize themselves with this Workplace Safety Program, the Hazard Communication Program, OSHA 29 CFR §~ 1926.900-914 Blasting and Use of Explosives standards, injury/incident reporting procedures and comply with all established safety procedures.

SAFETY COMMITTEE

WSDB established a safety committee that is composed of both salaried management members and hourly employee representatives; one of the three being a union steward and one employee alternate. The purpose of this committee is to provide on-going oversight of our safety and health programs.

The Safety Director will chair the committee and ensure safety committee meeting minutes are maintained.

Management members have been appointed to serve for the duration of their employment.

EMPLOYEE REPRESENTATIVES

To be nominated, employees must have obtained permanent, full-time status with the company, having remained in full time employment status for a minimum period of one year. Permanent full-time employees having met the above criteria will be referred by management to the employee population for election to the committee. Employees receiving the majority of employee votes will be appointed.

Safety committee functions consist of the following duties:

1. Be receptive and open to employee safety concerns. Ensure employee concerns are addressed by the foreman or superintendent responsible for the work area involved.

2. Hold quarterly meetings.

3. Maintain minutes of the meeting. Records must be maintained for at least 3 years.

4. Discuss and report the unfinished business of the previous meeting, if any.

5. Review quarterly summary of-accidents and injuries, and safety inspection reports to ensure hazards have been addressed.

6. Participate in periodic safety inspections in their assigned work areas.

7. Assist by recommending hazard elimination or reduction measures when hazards are discovered in their work areas.

8. Assist in distribution and/or dissemination of safety information to employees.

9. Discuss new ideas for improving the overall effectiveness of the safety program. Review the company safety and health programs annually. Make suggestions concerning revision, and update.

Note: All safety committee members will be instructed on all aspects of the committee function.

EMPLOYEE TRAINING

All current employees will be afforded an opportunity to read, review and discuss this written Workplace Safety Program.

1. Foremen/superintendents will ensure that copies are made available for employee review.

2. Employees will sign a training document to verify that they have read and understand the procedures and rules.

All new hires will receive safety orientation training from the Safety Director (job specific safety training will be conducted by their immediate supervisor). This training will include the following:

1. An opportunity to read, review and discuss the "Rights and Responsibilities" pamphlet.

2. An opportunity to read, review and discuss the written Safety and Health Programs.

3. Job specific training on safe working conditions and safe work practices unique to their assignments and work areas. Training may include drilling and blasting procedures, use of hazardous chemicals and explosives, use and limitations of personal protective equipment, evacuation procedures, and fire prevention, among others (Employees who work on mine sites will receive training as prescribed by MSHA.)

Superintendents, foremen and Safety Committee members will receive training to enable them to fulfill the functions which have been delegated to them by this program.

Refresher safety training will be provided annually and will include review of the written Safety and Health Programs.

Superintendents/Foremen will conduct periodic safety meetings in their work areas to update safety information and provide a forum for discussion of relevant safety matters.

When new processes and operations are introduced, employees will receive specific safety training relating to the new work assignments.

All safety training must be documented, copies forwarded to the Safety Director, and maintained for a period of 3 years.

BLASTER TRAINING

WSDB management personnel, experienced in blasting, will give the initial training. Currently WSDB has a blasters training meeting every quarter.

This program will be expanded to include the entire blast crew members on a quarterly basis. Training is also available from blasting consultants and will be scheduled in addition to regularly scheduled training by WSDB .

Newly hired blast crew members receive job orientation and training before they are allowed to go out on the job. Once the employee is on the job, they receive training by the blaster in charge. No new blast crew employee is assigned to load holes or to tie in a shot until the blaster in charge is confident the employee is trained and capable of doing so.

All training will be documented using the company-training log (See Appendix C) and records will be maintained at the corporate office.

DRILLER TRAINING

WSDB management personnel, experienced in drilling, will give the initial training.

Driller training will occur at regular intervals, not less than semi-annually.

Newly hired drillers will receive job orientation and training before they are allowed to go out on the job.

Once the employee is on the job, they receive training by the drill manager. All training will be documented using the company-training log (See Appendix C) and records will be maintained at the corporate office.

PRE-DRILL

1. Use appropriate personal protective equipment.
2. Inspects and assesses site conditions.
3. Conducts equipment pre-operational inspection.
4. Identifies, manages and reports hazards and potential risks according to work plan.
5. Uses approved dust suppressant.
6. Maintains personal safety and surrounding personnel.
7. Operates equipment safely within working environment limitations and face/ground conditions.
8. Interprets drill plans then drills holes and realigns equipment according to drill design.

9. Monitors site conditions and adjusts drilling techniques and components to maintain drilling operations.

10. Maintain drill log (See Appendix A)

DRILLING PROCEDURES

All drill holes need to be loadable. This means all holes need to be:

1. Drilled vertically, if a hole is not completely vertical (straight up and down) there could be a chance of intersecting with another hole. This is more common with deeper cuts and tighter patterns. If holes intersect than this could result in two holes firing at the same time, which creates timing problems, leading to vibration and air blast issues.

2. The Pattern is also a crucial part of drilling. When a pattern is laid out it needs to at a 90-degree angle. If the pattern is not squared it will affect the blaster in that they cannot time it properly. If you notice the pattern is not correct let your supervisor know and do not drill it until it is properly laid out.

3. Bit size is to be established before you drill. The blaster in charge decides this. Make sure to ask what size bit you need when you start a new pattern in a new area.

4. Collaring is the key to a loadable hole. Time needs to be taken when starting a hole; it is imperative that the top of the hole, also called the collar, be properly done. If this is done incorrectly the hole will collapse and it will be unloadable. If you need help in collaring ask your supervisor or the drill manager.

5. After the driller has collared the hole he must be aware of how the ground drills by doing the following:

    a. Watch the cuttings coming out of the hole. The conditions underground are hard to know so it is important to watch what comes out of the hole.

    b. If the driller notices that the cuttings are not coming out of the hole and the steel is traveling down at a faster rate than normal this would indicate that there is a void under the surface. If a void is encountered the driller must make a note on the drill log, then mark that hole by circling it with paint.

    c. When a void or seam is discovered under the surface, air and dust will come out of the holes near the one that is presently being drilled. When this happens, the driller must mark all of the holes that dust was coming out of and let the supervisor know immediately.

6. If the drill runs out of water, the driller must discontinue drilling

7. The driller must try not to create dust when drilling or tramming. If the area he needs to tram on is dusty, the superintendent must be contacted, and the area must be watered.

8. All holes must be drilled to the predetermined depth.

    a. All hole depths are to be determined by the job superintendent, not the driller

9. A drill log must be completed daily and turned in with the daily time card.

10. Tools required for the job may include:

a. Crescent Wrench
b. Pipe Wrench
c. 100’ tape and 30’ tape
d. Knife
e. Hammer
f. Standard Screwdriver

USE OF EXPLOSIVES
GENERAL PROVISIONS

1. The employer shall permit only authorized and qualified persons to handle and use explosives as stipulated in W.A.C. 296-52-67045

2. Smoking, firearms, matches, open flame lamps, and other fires, flame or heat producing devices and sparks shall be prohibited in or near explosive magazines or while explosives are being handled, transported or used as stipulated in part 3 W.A.C. 296-52-69055

3. No person shall be allowed to handle or use explosives while under the influence of intoxicating liquors, narcotics, or other dangerous drugs as stipulated in part 2 of W.A.C. 296-52-64020

4. All explosives shall be accounted for at all times. Explosives not being used shall be kept in a locked magazine, unavailable to persons not authorized to handle them. The employer shall maintain an inventory and use record of all explosives. Appropriate authorities shall be notified of any loss, theft, or unauthorized entry into a magazine as stipulated in part 2 of W.A.C. 296-52-69050

5. No explosives or blasting agents shall be abandoned.

6. No fire shall be fought where the fire is in imminent danger of contact with explosives. All employees shall be removed to a safe area and the fire area guarded against intruders.

7. Original containers shall be used for taking detonators and other explosives from storage magazines to the blasting area.

8. When blasting is done in congested areas or in proximity to a structure, railway, or highway, or any other installation that may be damaged, the blaster shall take special precautions in loading, delaying, initiation, and confinement of each blast to control the throw of fragments thus preventing bodily injury to employees or others.

9. Employees authorized to prepare explosive charges or conduct blasting operations shall use every reasonable precaution including, but not limited to, visual and audible warning signals, flags and barricades.

10. Empty boxes, paper and fiber packing materials, which have previously contained high explosives, shall not be used again for any purpose, but shall be disposed of at an approved location.

11. Explosives, blasting agents, and blasting supplies that have obviously deteriorated or been in some way damaged shall not be used.

12. Delivery and issue of explosives shall only be made by and to authorized persons. Said explosives shall only be stored in authorized magazines or approved temporary storage or handling areas.

13. Blasting operations in the proximity of overhead, power lines, communication lines, utility services, or other services and structures shall not be carried on until the operators and/or owners have been notified and measures for safe control have been taken as stipulated in part vii letter C of W.A.C. 296-52-67090.

LOADING OF EXPLOSIVES OR BLASTING AGENTS

1. Procedures that permit safe and efficient loading shall be established before loading is started.

2. All drill holes shall be sufficiently large to admit freely the insertion of the cartridges of explosives as stipulated in part 3 Letter C of W.A.C. 296-52-67080.

3. Tamping shall be done only with wood rods. The primer shall never be tamped as stipulated in part 4 of W.A.C. 296-52-67085.

4. No holes shall be loaded except those to be fired in the next round of blasting as stipulated in part 3 of W.A.C. 296-52-67085.

5. Drilling shall not be started until all remaining butts of old holes are examined for unexploded charges as stipulated in part 1 letter A item ii of W.A.C. 296-52-67080.

6. No person shall be allowed to deepen drill holes which have contained explosives or blasting agents as stipulated in part 3 Letter B of W.A.C. 296-52-67080.

7. No explosives or blasting agents shall be left unattended at the blast site as stipulated in part 7 of W.A.C. 296-52-67085.

8. Machines and all tools not used for loading explosives into bore holes shall be removed from the immediate location of holes before explosives are delivered.

9. Equipment shall not be operated within 50 feet of loaded holes as stipulated in part 2 Letter B of W.A.C. 296-52-67080.

10. No activity of any nature other than that which is required for loading with explosives shall be permitted in a blast area.

11. All blast holes in open work area shall be stemmed with inert material to the collar or to a point which will confine the charge as stipulated in part 6 of W.A.C. 296-52-67085.

12. Warning signs, indicating a blast area, shall be maintained at all approaches to the blast area as stipulated in of W.A.C. 296-52-60760.

13. No loaded holes shall be left unattended or unprotected as stipulated in part 7 of W.A.C. 296-52-67085.

14. The blaster shall keep an accurate, up-to-date record of explosives, blasting agents, and blasting supplies used in a blast and shall keep an accurate running inventory of all explosives and blasting agents stored on the operation. Unused explosives will be returned to the magazine or day box after use as stipulated in part 8 of W.A.C. 296-52-67085.

USE OF DETONATING CORD

1. No detonating cord will be allowed in close proximity to residential areas or occupied structure.

2. Care shall be taken to select a detonating cord consistent with the type and physical condition of the bore hole and stemming and the type of explosives used as stipulated in part 1 of W.A.C. 296-52-67100.

3. Detonating cord shall be handled and used with the same respect and care given other explosives as stipulated in part 2 of W.A.C. 296-52-67100.

4. The line of detonating cord extending out of a bore hole or from a charge shall be cut from the supply spool before loading the remainder of the bore hole or placing additional charges.

5. Detonating cord connections shall be competent and positive in accordance with approved and recommended methods. Knot-type or other cord-to-cord connections shall be made only with detonating cord in which the explosive core is dry as stipulated in part 5 Letter B of W.A.C. 296-52-67100.

6. All detonating cord trunklines and branchlines shall be free of loops, sharp kinks, or angles that direct the cord back toward the oncoming line of detonation as stipulated in part 4 of W.A.C. 296-52-67100.

7. All detonating cord connections shall be inspected before firing the blast as stipulated in part 5 Letter A item iii of W.A.C. 296-52-67100.

8. When detonating cord millisecond delay connectors or short-interval-delay electric blasting caps are used with detonating cord, the practice shall conform strictly to the manufacturer's recommendations as stipulated in part 5 Letter C item ii of W.A.C. 296-52-67100.

9. When connecting a blasting cap or an electric blasting cap to detonating cord, the cap shall be taped or otherwise attached securely along the side or the end of the detonating cord, with the end of the cap containing the explosive charge pointed in the direction in which the detonation is to proceed as stipulated in part 5 Letter C item i of W.A.C. 296-52-67100.

10. Detonators for firing the trunkline shall not be brought to the loading area nor attached to the detonating cord until everything else is in readiness for the blast.

FIRING THE BLAST

1. Area will be cleared of all surplus explosives, vehicles, personnel and equipment before pre-blast signals are initiated as stipulated in part 1 of W.A.C. 296-52-67105.

2. Before a blast is fired pre-blast signals will be fired (see Table U1).

3. Flagmen shall stop traffic during blasting operations as stipulated in part 4 of W.A.C. 296-52-67105.

TABLE U-I

WARNING SIGNAL	This signal will be given 5 minutes prior to the blast. It will consist of a series of long signals.
BLAST WARNING SIGNAL	This signal will be given 1 minute prior to the blast. It will consist of 5 short signals.
POST BLAST "ALL-CLEAR" SIGNAL	Following the blast (5-minute mandatory wait time), the licensed blaster will be responsible to inspect the blasting site to determine if any misfires, damage or other problems exist (i.e., loose high walls, unstable slopes, roadway damage, etc.). If a misfire is discovered, the licensed blaster will withdraw from the blasting site and wait at least 30-minutes before further investigation. Then the misfire procedures herein will be followed. When the blast-site inspection has been completed, and all issues have been safely resolved, the licensed blaster will then give the "all-clear" signal, which will consist of a single, prolonged, audible signal; after which traffic can be released.

POST-BLAST INSPECTION

Sufficient time shall be allowed for the dust and fumes to leave the blasted area before returning to the shot. An inspection of the area and the surrounding rubble shall be made by the blaster to determine if all charges have been exploded and an all clear signal shall be sounded before employees are allowed to return to the operation as stipulated in W.A.C. 296-52-67110.

MISFIRES

It is possible that a misfire could be discovered during three separate phases of the operation:

1. A misfire that is obvious during the detonation of the blast.

2. A misfire that is discovered during a post-blast inspection of the blasting site, or after the "all-clear" signal is given and

3. A misfired hole or undetonated explosive is discovered during some subsequent operation following the blast and the "all-clear" signal.

To assist in the discovery of misfires and to assure that they are properly cleared without undue hazards to persons or property, the following procedures will be followed by project personnel involved in the blasting operation:

OBVIOUS MISFIRE DURING BLAST

During the detonation of each blast, the blaster will carefully evaluate the blast detonation timing. If the blaster suspects that a misfire has occurred, he will immediately notify project management who will notify the project engineer and the Highway patrol (or traffic authority) of the likelihood of a misfire and the following steps will be taken:

1. The "all-clear" signal will not be given.
2. Traffic will not be released.
3. The blast site will remain guarded.
4. Following a mandatory 30 minute waiting period following the blast, the blaster and only those personnel necessary to the task will approach and investigate the suspected misfire.

MISFIRE DISCOVERED

If a misfire is discovered during a post-blast inspection; the licensed blaster will immediately notify project management and the project engineer and coordinate with them the steps he will be taking to properly clear the misfire. If the blaster determines that the area of potential hazard has increased beyond that of the original blast, the blast area will be cleared to new limits. The blaster will not proceed to clear the misfire until the area has been secured. He will then take the

necessary steps to safely clear the misfire. While this is being accomplished, the blast site will remain guarded.

Following successful clearing of the misfire and a subsequent inspection of the blast site by the blaster, he will give the order to sound the “all-clear” signal, after which traffic can be released.

IF NO MISFIRE IS FOUND

The licensed blaster will notify project management and will give the order to sound the “all-clear” signal; after which traffic can be released.

MISFIRE DISCOVERED DURING POST BLAST INSPECTION

After a minimum mandatory wait of 5 minutes after the blast, the blaster will conduct a thorough inspection of the blast site to e certain that no misfire exists.

MISFIRE DISCOVERED

If a misfire is discovered during a post-blast inspection; the licensed blaster will immediately notify project management and the project engineer and coordinate with them the steps he will be taking to properly clear the misfire. The “all-clear” signal will not be given, traffic will not be released and the blast site will continue to remain guarded. Following a minimum mandatory 30-minute wait after the blast, the blaster and only those personnel necessary to the task will approach and investigate the misfire.

If the blaster determines that the area of potential hazard has increased beyond that of the original blast, the blast area will be cleared to new limits. The blaster will not proceed to clear the misfire until the area has been secured. He will then take the necessary steps to safely clear the misfire. While this is being accomplished, the blast site will remain guarded. Following successful clearing of the misfire and a subsequent inspection of the blast site by the blaster, he will give the order to sound the “all-clear” signal, after which traffic can be released.

Following successful clearing of the misfire and a subsequent inspection of the blast site by the blaster, he will give the order to sound the “all-clear” signal, after which traffic can be released.

IF NO MISFIRE IS FOUND

The licensed blaster will notify project management and will give the order to sound the “all-clear” signal; after which traffic can be released.

MISFIRE DISCOVERED IN SUBSEQUENT OPERATION

In the event that an unexploded charge is discovered during some subsequent operation following blasting (i.e. excavating, loading, hauling, etc.), the following steps will be taken:

1. The person discovering the undetonated charge will immediately notify the licensed blaster, project management and the project engineer, and take steps to guard the charge.

2. Excavating, loading, hauling and other activities in the immediate vicinity of the blast zone will be suspended.

3. Excavating, loading, hauling and other activities in the immediate vicinity of the blast zone will be suspended.

4. The licensed blaster will proceed to the area and will evaluate the problem and determine the likelihood of additional explosive charges being involved. After this inspection, safe remediation procedures will be developed.

5. If the inspection reveals that one or more individual cartridges of explosive require removal from the site, the explosives will be returned to storage or destroyed.

6. If the inspection reveals that explosives will have to be fired in place or removed from the drill hole, the licensed blaster will advise project management and the project engineer of the steps necessary to properly clear the misfire.

7. The licensed blaster will determine the area surrounding the misfire that needs to be cleared and secured for safety. Steps will be taken to properly secure the area, including notification of the Highway Patrol (or traffic authority).

8. The blaster will then proceed to clear the misfire, If clearing the misfire involves detonating the explosives, all provisions of this AELASP and of the Explosive Safety Orders pertaining to the firing of blasts will be followed.

9. Following successful clearing of the misfire and a subsequent inspection of the blast site by the blaster, he will give the order to sound the “all-clear” signal after which traffic can be released.

DISPOSAL OF EXPLOSIVES

The blaster in charge is ultimately responsible for the explosives from the time they are retrieved from the magazine until they are returned. He must take time to inventory explosives.

The blaster in charge shall limit the number of workers involved in laying out the explosives. The blaster in charge shall maintain order during the process of removing explosives from the truck and returning them after the shot is laid out.

Explosives packages and boxes shall be broken down as they are emptied! Quick but effective examination shall be made before any empty explosives package is discarded. Never assume that a package is empty until the following procedure is performed:

Note: Gloves must be worn when handling empty explosives or blasting agent packages.

ANFO

1. Immediately after the product is used, hold bag upside down and quickly shake.

2. Place nine (9) bags together, as they are being used, then neatly fold and stuff' them into a tenth empty bag. Each bundle shall account for ten (10) bags.

DIVISION 1.1 – HIGH EXPLOSIVES (STICK POWDER, BOOSTERS, ETC.)

1. After using all product in the fiberboard case, quickly but thoroughly examine the case for stick powder, boosters, etc. Take out any plastic liners or similar materials and examine them as well.

2. Break the fiberboard case down by pulling the glued areas apart at the Juncture points. Perform this step on both the top and bottom of each fiberboard case.

3. Neatly stack the flattened boxes for transportation and disposal.

DETONATORS

1. After using all product in the fiberboard case, quickly but thoroughly examine the case for any remaining detonators. Take out any plastic or foil liners and examine them for remaining product. Interior cartons must be opened and thoroughly examined as well.

2. Break the fiberboard case down by pulling the glued areas apart at the juncture points. Perform this step on the top, bottom and interior cartons of each fiberboard case.

3. Neatly stack the flattened boxes for transportation and disposal.

METHODS OF DISPOSAL

All blasting procedures will be done locally so that all packages can be transported to the landfill, per special arrangement and approval.

Special provisions for actual disposal of packages accumulated on out-of-town job sites shall be reviewed with the company safety director. This review shall be conducted on a per Job basis and any approval for variance must be in writing from the safety director or a company officer.

TRANSPORTATION OF EXPLOSIVES

GENERAL PROVISIONS

1. Transportation of explosives shall meet the provisions of Department of Transportation regulations contained in 46 CFR Parts 146-149, Water Carriers; 49 CFR Parts 171-179, Highways and Railways; 49 CFR Part 195, Pipelines; and 49 CFR Parts 390-397, Motor Carriers.

2. Motor vehicles or conveyances transporting explosives shall only be driven by, and be in the charge of, a licensed driver who is physically fit. He shall be familiar with the local, State, and Federal regulation governing the transportation of explosives as stipulated in W.A.C. 296-52-68060

3. No person shall smoke, or carry matches or any other flame-producing device, nor shall firearms or loaded cartridges be carried while in or near a motor vehicle or conveyance transporting explosives as stipulated in item 1 of W.A.C. 296-52-68020.

4. Explosives, blasting agents, and blasting supplies shall not be transported with other materials or cargoes. Blasting caps shall not be transported in the same cargo area with other explosives as stipulated in part 1 of W.A.C. 296-52-68065.

5. Vehicles used for transporting explosives will have adequate GVW and shall be in good mechanical condition as stipulated in W.A.C. 296-52-68040.

6. Every motor vehicle or conveyance used for transporting explosives shall be marked or placarded on all sides, the front, the sides, and the rear as stipulated in W.A.C. 296-52-68050.

7. Each vehicle used for transportation of explosives shall be equipped with a fully charged fire extinguisher, in good condition. An Underwriters Laboratory-approved fire extinguisher of not less than 10-ABC rating will meet the minimum requirement. The driver shall be trained in the use of the extinguisher on his vehicle as stipulated in W.A.C. 296-52-68055.

8. Motor vehicles or conveyances carrying explosives, blasting agents, or blasting supplies, shall not be taken inside a garage or shop for repairs or servicing.

9. No motor vehicle transporting explosives shall be left unattended as stipulated in part 4 W.A.C. 296-52-68060.

CHECKLIST AND WARNINGS

The following certificates, licenses, papers and equipment must be in each commercial vehicle or any vehicle that transports hazardous materials:

1. Current RSPA registration (D.O.T Pipeline)
2. Current vehicle registration
3. Current Certificate of Insurance
4. Pre-trip/Post-trip inspections-past 90 days and current w/blanks
5. Trip Manifest (Shipping Paper) and Routing Instruction Sheet
6. Valid Commercial Drivers License with Hazardous Materials Endorsement
7. Valid DOT approved physical examination card (Health Card)
8. Federal Motor Carrier Safety Regs. Pocketbook (green & white)
9. Emergency Response Guidebook (yellow/gold) (2009)
10. Emergency Instructions/Procedures sheet
11. Blank vehicle accident forms
12. Fire Extinguishers w/current annual inspection, fully charged
13. Emergency reflective triangles, complete set
14. Four proper placards (If applicable)
15. Signs/decals indicating proper company name, city, state and DOT number
16. Log book (for trips that exceed a 100 mile radius of normal operations)

WSDB is aware that the Washington State highway patrol will be stopping our vehicles often for routine checks on the highways; management does all within their power to ensure compliance with all state and federal regulations.

When one of WSDB's employees gets behind the wheel of a commercial motor vehicle, they understand that they are responsible for the legal and safe operation of that vehicle. If they are cited for failure of any of the above items, they are responsible pay all associated fines.

The cargo area must be swept clean and the load must be protected and braced against load shifting before they leave the storage or job site.

Drivers can avoid the possibility of citations by following company safety rules. It is crucial that they complete all shipping forms, logs and pre/post-trip inspection forms correctly and that they turn them into the office. Questions regarding these safety regulations should be directed to the Safety Director.

STORAGE OF EXPLOSIVES AND BLASTING AGENTS

1. Explosives and related materials shall be stored in approved facilities required under the applicable provisions of the Bureau of Alcohol, Tobacco and Firearms regulations contained in 27 CFR Part 555.

2. Blasting caps, electric blasting caps, detonating primers, and primed cartridges shall not be stored in the same magazine with other explosives or blasting agents as stipulated in W.A.C. 296-52-69005.

3. Smoking and open flames shall not be permitted within 50 feet of explosives and detonator storage magazine as stipulated in part 3 of W.A.C. 296-52-69050.

EXPLOSIVES STORAGE-SITE MANAGEMENT AND PROCEDURE

Failure to comply with these requirements will result in appropriate discipline.

1. No unauthorized person is allowed in or around the magazine site.

2. All gates and magazines are to be locked upon leaving the site.

3. The area surrounding the magazines and storage trailers are to be kept clean. All flammable debris, including wood, foliage and trash must be removed from around the site.

4. Any spilled product must be cleaned up immediately. Product must never be left on the ground.

5. Any product spilled in the ANFO trailer must be cleaned up immediately.

6. Magazine inventory sheets must be filled out every time product is put in or taken out of the magazine. The individual making the last entry “is responsible for insuring that it reflects what is truly on hand. Inventory sheets must be immediately turned into the office when they are full of entries.

7. All empty explosives cases returned to the magazine site must be broken down and placed in the trash trailer. This material shall be stacked as close to the nose of the trailer as is possible in order to avoid re-stacking several times.

8. When a load of explosives is received at the magazine site, the individual who meets the load shall remain at the magazine site until the entire load is properly stored and inventoried.

BLAST REPORT PREPARATION AND REVIEW

PURPOSE

Provide accurate and timely blast records

DISCUSSION

Blast reports are essential legal records which must be prepared and retained for each blast conducted by a licensed blaster. In order for these records to be meaningful and accurate they must be prepared in a timely manner, be complete with all information necessary to accurately document materials used, blast design, location, date and time of blast and blast performance to include noise, vibration, fragmentation, movement and any notable occurrences associated with the blast.

BLAST REPORT PREPARATION

The following actions must be completed by the blaster in charge for each blast executed on behalf of Western States Drilling and Blasting.

1. Prior to blasting, obtain a blast report number from the company office via telephone to 702-558-4900. Record the blast number in the space provided on the blank form.

2. Obtain job number and ticket number from job superintendent and record appropriately.

3. Record blast location using GPS coordinates for each corner of blast.

4. Record a customer name and address.

5. Record seismograph locations and post blast reading.

6. Record all explosives and materials used including date codes and quantity.

7. Provide an accurate and complete shot diagram, including hole diameter, hole depth, burden, spacing, stemming length, stemming description, explosive column length, decks (if used) booster, cap description and firing sequence showing point of initiation and time between holes and rows. Note on diagram blocked holes, shallow holes, any unusual situations such as absence of drill cuttings, fractured surface, wet hole, different material or any observation which might be useful in explaining an unexpected result.

8. Record the names of all personnel participating in activities.

9. Sign the blast report, realizing that you are signing a legally binding document that has the potential of either protecting you and the company or causing serious damage in a court of law to both.

a. Completely review the blast report and verify that each provided spaced is completed or marked N/A as appropriate.

b. Provide completed blast report, daily, to the receptionist at WSDB company office not later than 24 hours following blast time. Blast reports can be submitted via email, fax or hand delivered.

c. Complete blasters checklist (See Appendix B) and have job manager initial checklist.

OPERATOR MAINTENANCE

1. Visually inspects equipment and reports faults and makes equipment available for routine operational servicing

2. Makes minor adjustments to equipment

3. Cleans equipment to maintain condition of equipment and ensure safe and efficient operations.

4. Completes all required documentation clearly, concisely and on time

Appendix A – Drill Log

Shot#_____ Job #_____Bit Size____ Pattern _____ Date_____ Name_____

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
1																				
2																				
3																				
4																				
5																				
6																				
7																				
8																				
9																				
10																				
11																				
12																				
13																				
14																				
15																				
16																				
17																				
18																				
19																				

Appendix B – Blaster Checklist

Check List

Date:_____

Job Number:_____ Shot Number:_____

1. BEFORE BLASTING

NOTIFICATION
- ☐ Fire Department
- ☐ Utilities
- ☐ Businesses & Home Owners
- ☐ Seismograph Tech
- Other (List)

_____
_____

MATERIAL & EQUIPMENT
- ☐ Adequate Stemming Material
- ☐ Warning Signs
- ☐ Warning Signals
- ☐ Safe Amount of Lead Line
- ☐ Seismograph Paper, Pens, etc.
- ☐ Fire Extinguishers (charged)
- ☐ Adequate Blasting Shelter
- ☐ Mats (If Applicable)

SHOT DESIGN
- ☐ Pattern OK for Area
- ☐ Sufficient Burden to Face
- ☐ Reviewed drill logs
- ☐ Measured Depth, Burden & & Spacing
- ☐ Shot Area Posted & Secure
- ☐ Shot Diagramed on Back

2. DURING LOADING

CONSTANT CHECKS
- ☐ Explosives
- ☐ Running Inventory
- ☐ Access Row Empty
- ☐ Drills & Traffic 50' Away
- ☐ Shot can be fired in case of emergency

All Holes to be checked & approved
- ☐ Blaster initial
- ☐ Supt initial

3. DETONATION

HOOK - UP
- ☐ All Unnecessary Crew Cleared
- ☐ All Holes Loaded & Stemmed
- ☐ Hand Check tubing Before Each Connection
- ☐ Visually Insured That Each Connection is Snapped

SECURE AREA
- ☐ Set up Seismograph
- ☐ Est. Checkpoints at Each Access
- ☐ Radio Communication with Checkpoints.
- ☐ Cleared People, Vehicles & Equipment
- ☐ Visual Coverage of Entire Site
- ☐ Five Minute Warning
- ☐ One Minute Warning

4. AFTER DETONATION

POST BLAST CHECK
- ☐ Waited for Dust & Fumes to Dissipate
- ☐ Walked Entire Area of Shot
- ☐ Insured that tail Surface Delays Fired at the End of Each Row
- ☐ Sounded All Clear Signal

LEGAL DOCUMENTATION
- ☐ Completed Shot Report
- ☐ Diagramed Shot w/ Seismograph Location (Direction & Distance)
- ☐ Recorded Seismic Results on Blast Report
- ☐ Final Inventory of Explosives Recorded Ticket Number Assigned By Job Supervisor
- ☐ Signed Blast Report w/ License No. Job Supervisor

Supt has checked and verified that all been complete and shot area is ready for loading.

☐ Supt initial

BLAST REPORT **Blast Report #** _____

☐ Sanders Construction, Inc. ☒ Western States Drilling & Blasting, Inc.

DATE: _____ EXACT TIME OF SHOT: _____

CUSTOMER: _____ JOB NO: _____

SHOT LOCATION WITH GPS COORDINATES: _____ TICKET NO: _____

_____ CHECK LIST COMPLETED: ~~YES~~ NO

TYPE OF ROCK: _____ FACE HEIGHT: 0 FT. POUNDS PER DELAY: _____

TOTAL HOLES _____

NUMBER OF HOLES: _____ HOLE DIA: _____ B x S: _____ x _____ STEMMING: _____ DEPTH: _____

NUMBER OF HOLES: _____ HOLE DIA: _____ B x S: _____ x _____ STEMMING: _____ DEPTH: _____

POWDER FACTOR: _____ LBS. OF EXPLOSIVES: _____ YARDS OF ROCK: _____

WEATHER: _____ WIND: _____

EXACT MONITOR LOCATION (GPS/CROSS ST./ADDRESS): DIRECTION FROM BLAST: _____ MONITOR TYPE: _____

_____

MONITOR: L/R _____ T _____ V _____ PVS _____ Db _____ MONITOR SERIAL NO: _____

DISTANCE TO BLAST: _____ AVERAGE POUNDS PER HOLE: _____ OPERATOR: _____

EXACT MONITOR LOCATION (GPS/CROSS ST./ADDRESS): DIRECTION FROM BLAST: _____ MONITOR TYPE: _____

_____

MONITOR: L/R _____ T _____ V _____ PVS _____ Db _____ MONITOR SERIAL NO: _____

DISTANCE TO BLAST: _____ AVERAGE POUNDS PER HOLE: _____ OPERATOR: _____

EXPLOSIVES

DESCRIPTION	QUANTITY USED	DATE CODE	MAGAZINE	REMOVED	RETURNED
BULK A/N	Lbs.				
BAG ANFO	Bags				
POWDER	ea.				
POWDER	ea.				
BOOSTER	ea.				
BOOSTER	ea.				
ft.	ea.				
ft.	ea.				
ft.	ea.				
ft.	ea.				
ft.	ea.				
ft.	ea.				
ft. ms	ea.				
Lead Line **Orica Lead-Line**	ft.				
GRAIN CORD	ft.				
MISCELLANEOUS					

COMMENTS:

_____

_____

_____

BLASTER'S SIGNATURE: _____ LICENSE NO: _____

ATTACH SKETCH OF SHOT

Revised 01.06.2006 THIS FORM MUST BE FILLED OUT COMPLETELY

WESTERN STATES
DRILLING AND BLASTING, INC.

SNOQUALMIE EAST CONSTRUCTION PROJECT
BLASTING DESIGN PARAMETERS

SNOQUALMIE EAST CONSTRUCTION PROJECT
BLASTING DESIGN PARAMETERS

All blast designs developed and utilized while conducting blasting operations on the Snoqualmie East construction project will adhere to all State of Washington Codes and the principles which are generally accepted industry wide.

PRESPLIT BLASTING

1. Presplit boreholes shall be accurately positioned along the top of cut lines as determined and staked by project survey crews.

2. Boreholes shall be aligned to provide the designated inclination (typically ¼ to 1) using state of the art instrumentation and controls provided on Atlas Copco 585 hydraulic drills and periodically confirmed by on-site management using hand held portable equipment.

3. Borehole diameter shall be 2 ½" or 3" depending on rock conditions at the specific blast site.

4. Borehole depth shall be a maximum of 26' to provide slight overlap for 24' vertical bench heights.

5. Boreholes shall be offset from the face by two feet (2) for each lift to allow for drill access and alignment.

6. Borehole spacing shall be set at 2' center to center at the collar.

7. Boreholes shall be uniformly loaded using a continuous packaged charge along the borehole up to a minimum of 3' from the collar at which point the hole shall be blocked using appropriate plugs and stemmed to the collar using screened aggregate.

8. The entire powder column will be traced with detonating cord of adequate strength to ensure complete and continuous detonation.

9. Surface initiation of presplit holes will be accomplished using tightly strung detonating cord of appropriate explosive and tensile strength to reliably initiate the down lines when properly attached at right angles to the trunk line.

10. The maximum number of holes will be initiated per 9ms delay as determined by vibration and air blast considerations.

11. Loaded vertical production blast holes will not be used closer than 3' from the final

presplit line in order to minimize back break.

12. Presplit holes will be fired either as a separate blast prior to drilling production blast holes or properly delayed as part of normal production blasting operations.

PRODUCTION BLASTING

1. Production blasting will be conducted using generally accepted design principles which fall within the criteria listed below.

2. Borehole diameter will be 2 ½" to 5" as determined by specific safety considerations, rock conditions, fragmentation specifications and specific geometry of the blast site.

3. Spacing will not be more than 1.8 times the design burden or less than 1.0 times the burden.

4. Stemming will not be less than 0.7 times the burden or more than 1.3 times the burden.

5. Sub-drill will not be less than 0.2 times the burden or more than 0.5 times the burden.

SPECIFIC BLAST DESIGNS

1. Specific blast designs will be based on the following considerations.
    a. Safety considerations
    b. Specific site rock conditions
    c. Specific site geometric considerations
    d. Production requirements

2. Performance objectives for blast design
    a. Maximize safety considerations
    b. Optimize quality of blast performance

GENERIC BLAST DESIGN CRITERIA

1. Minimize the quantity of explosive per delay

2. Maximize stemming consistent with fragmentation requirement

3. Maximize burden consistent with fragmentation and vibration requirements and restriction.

4. Direct primary direction of blasted rock movement to least affected area

5. Strongly consider all blast site specific conditions which could affect safety or blast performance, such as loose boulders, fractured face, loose overhanging rock, structure or equipment, personnel

NARRATIVE OF BLASTING PROGRAM

Using the technical and common sense directions outlined above it is our intention and commitment to conduct all drilling and blasting operation on this project in the safest, most efficient and productive manner possible. We plan to be responsive to changing conditions and requirements as the job progresses and to maintain a professional and friendly worksite atmosphere.

In order to accomplish all of the above we will take the overall approach outlined below.

1. Provide adequate personnel and equipment to perform the task.

2. Provide adequate on site supervision to ensure that the job site is properly cleared and prepared for access of men and equipment to safely perform the required tasks.

3. Respond quickly and responsibly to day by day requirements of the job.

GENERAL APPROACH TO THE JOB

We have carefully studied the plans, walked the job and called into play our experiences on past jobs which had similarities to this one and have decided that the most practical approach will be to first mechanically remove all loose rock and debris from the exposed and weathered face parallel to I-90. Large boulders may either be blasted or mechanically broken up as appropriate.

Following the initial prep work outlined above we are prepared to design and execute limited blasting to trim the face parallel to I-90 back from the West bound lane to provide for added workspace and to minimize the risk of blasted rock delaying traffic.

During the routine production, it is our intention to maximize the size of each individual blast site as far as practical in order to increase efficiency of blast fragmentation, reduce exposure and maximize production. Individual blasts will be designed utilizing boreholes up to 5" diameter in the central portion of the blast pattern with reduced diameter holes down to 2 ½" diameter as appropriate near the free face parallel to I-90 to minimize throw and in front of the presplit line to minimize back break. As far as practical, timing designs will provide for one hole per delay detonation and will in all cases maximize direction of rock movement toward least affected area, (normally parallel to I-90).

Non electric detonators will be used to initiate individual production holes, detonating cord and ms surface delays will be used to initiate presplit line. Cast boosters will be used to prime production holes 3" or greater in diameter. Production holes smaller than 3" diameter will be charged with cap sensitive emulsion or Nitro-glycerin sensitized explosives as dictated by safety

and performance considerations.

No electric or electronic caps will be stored or used on the jobsite, and only noiseless lead in (shock tube) will be used to initiate the blast. All expended tubing will be recovered and properly disposed of along with all empty containers and packaging.

EQUIPMENT ALLOCATION

1. Two (2) late model low hr. Atlas Copco 720 hydraulic drills

2. 0ne (1) late model low hr. Atlas Copco 585 hydraulic drill equipped with on-board state of the art boom positioning system which facilitates accurate placement and alignment of presplit boreholes

3. One explosives bulk truck capable of delivering customized formulations as needed for maximum design versatility

4. Multiple explosives magazines

5. Explosives, equipment and personnel transportation as required

WESTERN STATES
DRILLING AND BLASTING, INC.

LICENSES AND PERMITS

UNITED STATES OF AMERICA

The State of Washington

Secretary of State

I, SAM REED, Secretary of State of the State of Washington and custodian of its seal, hereby issue this

CERTIFICATE OF AUTHORITY

to

WESTERN STATES DRILLING AND BLASTING, INC.

a/an UT Profit Corporation. Charter documents are effective on the date indicated below.

Date: 5/3/2010

UBI Number: 602-988-442

APPID: 1640819

Given under my hand and the Seal of the State of Washington at Olympia, the State Capital

Sam Reed

Sam Reed, Secretary of State

STATE OF WASHINGTON

MASTER LICENSE SERVICE

PO Box 9034 • Olympia, WA 98507-9034 • (360) 664-1400

REGISTRATIONS AND LICENSES

Unified Business ID #: 602 988 442
Business ID #: 1
Location: 1

Foreign Profit Corporation

WESTERN STATES DRILLING AND BLASTING, INC.
2031 PABCO RD
HENDERSON NV 89011 2500

TAX REGISTRATION
INDUSTRIAL INSURANCE
UNEMPLOYMENT INSURANCE

REGISTERED TRADE NAMES:
WESTERN STATES DRILLING AND BLASTING, INC.

The licensee named above has been issued the business registrations or licenses listed. By accepting this document the licensee certifies the information provided on the application for these licenses was complete, true, and accurate to the best of his or her knowledge, and that business will be conducted in compliance with all applicable Washington state, county, and city regulations.

Elizabeth A. Luce
Director, Department of Licensing

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TATE OF WASHINGTO RATION DATE

442 1 1

ATES DRILLING AND BLASTING,
RD
NV 89011 2500

RATION
INSURANCE
NT INSURANCE

Elizabeth A. Luce
ector, Department of Licensing

THIS SECTION FOR YOUR WALLET

UNITED STATES OF AMERICA
DEPARTMENT OF TRANSPORTATION
PIPELINE AND HAZARDOUS MATERIALS SAFETY ADMINISTRATION

HAZARDOUS MATERIALS CERTIFICATE OF REGISTRATION FOR REGISTRATION YEAR(S) 2009-2010

Registrant: SANDERS CONSTRUCTION, INC
Attn: JOE DODD
PO BOX 92707
HENDERSON, NV 89009

This certifies that the registrant is registered with the U.S. Department of Transportation as required by 49 CFR Part 107, Subpart G.

This certificate is issued under the authority of 49 U.S.C. 5108. It is unlawful to alter or falsify this document.

Reg. No: 072709 550 022R Issued: 07/27/2009 Expires: 06/30/2010

Record Keeping Requirements for the Registration Program

The following must be maintained at the principal place of business for a period of three years from the date of issuance of this Certificate of Registration:

(1) A copy of the registration statement filed with PHMSA; and
(2) This Certificate of Registration

Each person subject to the registration requirement must furnish that person's Certificate of Registration (or a copy) and all other records and information pertaining to the information contained in the registration statement to an authorized representative or special agent of the U. S. Department of Transportation upon request.

Each motor carrier (private or for-hire) and each vessel operator subject to the registration requirement must keep a copy of the current Certificate of Registration or another document bearing the registration number identified as the "U.S. DOT Hazmat Reg. No." in each truck and truck tractor or vessel (trailers and semi-trailers not included) used to transport hazardous materials subject to the registration requirement. The Certificate of Registration or document bearing the registration number must be made available, upon request, to enforcement personnel.

For information, contact the Hazardous Materials Registration Manager, PHH-62, Pipeline and Hazardous Materials Safety Administration, U.S. Department of Transportation, 1200 New Jersey Avenue, SE, Washington, DC 20590, telephone (202) 366-4109.

DEPARTMENT OF JUSTICE

Bureau of Alcohol, Tobacco,
Firearms and Explosives

Martinsburg, WV 25405

December 7, 2009

Western States Drilling & Blasting Inc
PO Box 92707
Henderson, NV 89009

901090: CRR/LIO
5400
File Number: 9-NV-00090

Premises Address: 2031 Pabco Road, Henderson, NV 89015

Dear Sir/Madam:

This letter acknowledges receipt of your timely application to renew your Federal explosives license/permit.

The Bureau of Alcohol, Tobacco, Firearms and Explosives (ATF) is not able to process your application prior to the expiration date of your license/permit. However, Federal law allows you to continue operations under your current license/permit until such time as ATF completes processing your application. See 5 U.S.C. § 558. This letter, or as explained below, a follow-up letter, will serve as your license/permit until we complete action on your renewal. It is referred to as a Letter of Authorization (LOA).

Since we have not completed processing your application, you may supply a copy of this letter to other licensees/permittees, e.g., your distributors, for the next six months (or until we complete action on your renewal, if that occurs in less than six months) as evidence of your licensed/permitted status. If we have not completed processing your application for renewal within six months of the date of this letter, we will send you another letter, which will also be valid for six months (or until we complete action on your renewal, if that occurs in less than six months). This is of course contingent upon your remaining entitled to continue operations under your current license/permit.

Please direct questions or concerns regarding this letter to Lydia Otalora @ 304-616-4407.

Sincerely,

Christopher R. Lees

Chief, Federal Explosives Licensing Center

ATF web address: www.atf.gov

Michael

DEPARTMENT OF THE TREASURY - BUREAU OF ALCOHOL, TOBACCO AND FIREARMS

LICENSE/PERMIT (18 U.S.C. CHAPTER 40, EXPLOSIVES)

In accordance with the provisions of Title XI, Organized Crime Control Act of 1970, and the regulations issued thereunder (27 CFR Part 555)you may engage in the activity specified in this license/permit within the limitations of Chapter 40, Title 18, United States Code and the regulations issued thereunder, until the expiration date shown. See "WARNING" and "NOTICES" on back.

DIRECT ATF CORRESPONDENCE TO

Christopher R. Reeves
Chief, Federal Explosives Licensing Center (FELC)
Bureau of Alcohol, Tobacco, Firearms and Explosives
244 Needy Road
Martinsburg, West Virginia 25405
Telephone: 1-877-283-3352 Fax: 1-304-616-4401

LICENSE/PERMIT NUMBER: **9-NV-003-20-9L-00090**

EXPIRATION DATE: **November 1, 2009**

NAME

WESTERN STATES DRILLING & BLASTING INC

Premises Address CHANGES? You must notify the FELC at least 10 days before the move.

2031 PABCO ROAD
HENDERSON, NV 89015-

TYPE OF LICENSE OR PERMIT

20-MANUFACTURER OF HIGH EXPLOSIVES

CHIEF, FEDERAL EXPLOSIVES LICENSING CENTER (FELC)

Christopher R. Reeves

Christopher R. Reeves

PURCHASING CERTIFICATION

I certify that this is a true copy of a license/permit issued to me to engage in the activity specified.

(SIGNATURE OF LICENSEE/PERMITTEE)

Mailing Address CHANGES? You must notify the FELC at least 10 days before the change.

WESTERN STATES DRILLING & BLASTING INC
PO BOX 92707
HENDERSON, NV 89009-

The licensee/permittee named herein shall use a reproduction of this license/permit to assist a transferor of explosives to verify the identity and status of the licensee/permittee as provided in 27 CFR Part 555. The signature on each reproduction must be an ORIGINAL signature.

ATF F 5400.14/5400.15, Part 1 (8/89)

DEPARTMENT OF LABOR AND INDUSTRIES

REGISTERED AS PROVIDED BY LAW AS
CONST CONTR DRILL/SOIL

	REGIST. #	EXP. DATE
CCSH	WESTESD904DB	3/2/2012
EFFECTIVE DATE		3/2/2010

WESTERN STATES DRLG/BLTG INC
PO BOX 92707
HENDERSON NV 89009

F625-052-000 (8/97)

For Address Correction Or Move Notification, Complete Below and mail.

City State ZIP+4

Address

dba (if applicable)

Name

DEPARTMENT OF LABOR AND INDUSTRIES
PO BOX 44450
OLYMPIA WA 98504-4450

License/Certificate Number

Important: In order for you to receive a renewal notice, it is your responsibility to keep this Division informed of your current mailing address. Failure to supply the correct address may result in your renewal notice being "lost" in the mail. Failure to renew within the proper time frame may result in your retaking the qualifying test.

For your convenience, L&I address to the left will show through a window envelope.

F625-052-000 (8-97)

Detach And Display Certificate

REGISTERED AS PROVIDED BY LAW AS
CONST CONTR DRILL/SOIL

	REGIST. #	EXP. DATE
CCSH	WESTESD904DB	3/2/2012
EFFECTIVE DATE		3/2/2010

WESTERN STATES DRLG/BLTG INC
PO BOX 92707
HENDERSON NV 89009

Signature

Issued by DEPARTMENT OF LABOR AND INDUSTRIES

Please Remove And Sign Identification Card Before Placing In Billfold

F625-052-000 (8/97)

WESTERN STATES
DRILLING AND BLASTING, INC.

COMPANY RESUMES

DANIEL M. SANDERS

440 Paradise Hills · Henderson, NV 89015 · 702-564-3369

EMPLOYMENT

PRESIDENT 1979 - PRESENT
Sanders Construction, Inc. Henderson, Nevada

1. Responsible for building business from a single-drill company with sales of less than $200,000 to the largest drilling and blasting company in the State of Nevada with annual sales in excess of $5,000,000.

PRESIDENT 1985-PRESENT
Western States Drilling And Blasting, Inc. Henderson, Nevada

1. Responsible for forming Western States Drilling And Blasting, Inc. to provide drilling and blasting services in Arizona, Utah, and Idaho.
2. Oversaw growth of company from a start-up company to sales in excess of $3,000,000.

PRESIDENT 1991-1997
SANDEX, INC. Henderson, Nevada

BOARD OF DIRECTORS 1997-AUG 2002
Sandex, Inc. Henderson, Nevada

1. Responsible for forming Sandex, Inc. in 1991 as an Explosives Distributor (1991-1997) for Nevada and surrounding states.
2. Sandex was incorporated in 1997 for the purposes of being a union drilling and blasting contractor in the State of Nevada.

MANAGER 2002-PRESENT
BlastWest, LLC Henderson, Nevada

1. Responsible for formation of BlastWest, LLC in 1992 to provide management services for three related companies (Sanders Construction, Inc., Western States Drilling And Blasting, Inc. and Sandex, Inc.).

DANIEL M. SANDERS

440 Paradise Hills · Henderson, NV 89015 · 702-564-3369

EDUCATION

Brigham Young University **1973-74, 1976-77**
Provo, Utah

1. Completed courses in business and general education before leaving to take a position with Sanders Construction, Inc.

GENERAL EDUCATION **1969 - 1973**
Basic High School
Henderson, Nevada

COMMUNITY SERVICE

1. Served Mission to Brazil for **The Church of Jesus Christ of Latter-day Saints** (Aug. 1974-Aug. 1976)
2. Commissioner for the Boulder Dam Area Council of the **Boy Scouts of America** (mid 1980's)
3. Member of the **City of Las Vegas Blasting Committee.** (Approx. 1989-91)
4. Established blasting regulations for the City of Las Vegas, including a blasting video to educate citizens around blasting activities about the safety involved in blasting.
5. Member of Board of Directors for the **Henderson Little League** (1997)
6. Member of the **Clark County Clean Air Task Force** (1997)
7. Member of the **City of Henderson Planning Commission** (1995-Present)
8. Chairman of the **City of Henderson Planning Commission** (1998)
9. Chairman - **El Dorado District Boy Scouts of America** (1998 - Present)
10. Member - **Clark County Air Quality Hearing Board** (1998 - Present)

PROFESSIONAL MEMBERSHIPS & PUBLICATIONS

1. Member of the International Society of Explosives Engineers
2. Member of the Associated General Contractors, Southern Nevada Chapter
3. "RESIDENTIAL BLAST COMPLAINT REDUCTION"
4. with F.M. Babcock and Sheila Luchansky
5. Proceedings of the Nineteenth Conference on Explosives and Blasting Technique, International Society of Explosives Engineers, January 31, to February 4, 1993, San Diego, California.

CERTIFICATION

1. Certified Blaster, State of Nevada since December 1972

Charles H. Murphy
1860 Starr Road
Monticello, Georgia 31064

Home 706-468-9191
Cell 706-819-8438

ACADEMIC CREDENTIALS

Bachelor of Mechanical Engineering
Georgia Institute of Technology 1962

Graduate School Studies MBA
Florida State University 1967

CAREER ACHIEVEMENTS

OVERSAW/MONITORED/SUPERVISED

1. Sales, blast design, blast operations, regulatory compliance, transportation and storage for successful explosives distributors and drilling and blasting companies in Middle, Tennessee and Southern Nevada with projects completed in eight Eastern states and six Western states.

DEVELOPED/EVALUATED/COACHED

2. Three lead technicians, indirectly supervising 21 other technicians with operational and maintenance responsibility for 23 light to heavy vehicles.
   RESULTS Work force stabilized with skill levels continually increasing along with gross and net profits.

EVALUATED/NEGOTIATED/CONDUCTED

3. Sales and service program to correct operational problems and obtain sales contract with largest crushed stone facility on the Cumberland Plateau in Tennessee.
   RESULTS: Signed contracts to supply explosive products and services for production of 500,000 tons of crushed stone per year. Improved profitability and quality for customer.

OVERSAW/FORMULATED/ENGINEERED

4. Facility, personnel and equipment requirements to conduct experiment to evaluate the effects of chemical agents on a ship at sea.
   RESULTS: Experiment provided vital engineering data for use in designing systems to be used aboard navy ships for operations in a chemical/biological warfare environment.

DESIGNED/ORGANIZED/SUPERVISED

5. Construction and operation of a tropical jungle test site manned by 150 technicians for the evaluation of non-lethal chemical weapons in a jungle environment.
   RESULTS: The six month long program was completed on schedule, on budget and provided essential data used to design systems and strategies in support of the war in Southeast Asia.

HEADED/DIRECTED/SYSTEMIZED

6. Explosives manufacturing factories in Utah, Missouri and Puerto Rico while supervising three plant managers and their combined staffs of approximately 75 employees.
   RESULTS: Approximately 10 million pounds of explosives were profitably produced under my supervision without a single explosives incident occurring.

LAUNCHED/MODERATED/COORDINATED

7. The assessment needs of the workplace environment for an international resort facility.
   RESULTS: Created a "user-friendly" relationship, atmosphere for all concerned by solving problems before they developed.

PROFESSIONAL HISTORY

SANDERS CONSTRUCTION, INC.
WESTERN STATES DRILLING AND BLASTING
LAS VEGAS, NEVADA

FEBRUARY 2002-OCTOBER 2007

BLASTING OPERATIONS MANAGER

1. Direct supervision of up to 25 personnel daily performing blasting operations in Southern Nevada and Western states.

2. Provided detailed blast designs for all critical locations and personal on-site supervision for especially sensitive locations.

SIGNIFICANT AND RELEVANT PROJECTS:

1. Foundation blasting for City Center project located on Las Vegas Strip.

2. Rerouting of Highway 93 approach to new bridge below Hoover Dam. Extremely sensitive environmental and safety issues regarding blast designs directly above discharge structures and underneath critical power lines.

3. Widening of US 26/287 between Moran Junction and Dubois, Wyoming. Project consisted of two major cuts, 100 to 150' high adjacent to a major tourist route requiring very careful control of fly rock and precise pre-split blasting in deteriorated stone.

4. Surface blasting at Western Gypsum Mine, Black Rock, AZ. Production rates of Up to 1,000,000 cubic yards per month were achieved using two DM45 6 ½" drills and a single blast crew. Drilling and blasting operations were under my direct supervision.

RETIRED NOVEMBER 2007.

CALLED BACK TO ACTIVE STATUS FOR SUPERVISION OF DRILLING AND BLASTING OPERATIONS ON SNOWQUALMIE PASS I-90 WIDENING PROJECT.

SENIOR TECHNICAL/CUSTOMER SERVICE REPRESENTATIVE
AUSTIN POWDER COMPANY
LAS VEGAS, NEVADA

SEPTEMBER 2000-FEBRUARY 2002

1. Serviced Southern Nevada market providing direct supervision and hands-on shot service to construction, quarry and mining operations.
    a. Most blasting locations were very close to highly developed and populated sections of Las Vegas and Henderson, Nevada, requiring very close supervision and precise designs in order to minimize noise, vibration, dust and fly-rock hazards.

AUSTIN WITHDREW FROM MARKET IN FEBRUARY 2002

OPERATIONS MANAGER
HERMITAGE EXPLOSIVES CORPORATION
NASHVILLE, TENNESSEE

FEBRUARY 1996-AUGUST 2000 (RETIRED AUGUST 2000)

1. Strengthened/Organized/Supervised the operations department consisting of a staff of 22 technical, operations, and sales personnel.
2. Performed hands-on blasting operations for site development, interstate highways, quarries and mining.

SENIOR TECHNICAL REPRESENTATIVE
DYNO NOBEL, INC.
SALT LAKE CITY, UTAH

JANUARY 1993-JANUARY 1996

1. Headed/Directed/Provided technical support for ten explosives distribution companies in Eastern United States in the form of technology transfers, quality assurance monitoring, operations support, and training programs.

DIRECTOR DEFENSE SYSTEMS DIVISION
DYNO NOBEL INC.
SALT LAKE CITY, UTAH

JANUARY 1984-DECEMBER 1992

1. Organized/Supervised/Innovated projects, personnel and ideas to establish and operate a highly successful business unit for the production and sale of explosive products.

DIRECTOR OF ENGINEERING
CALLAWAY GARDENS
PINE MOUNTAIN, GEORGIA

SEPTEMBER 1978-DECEMBER 1983

1. Evaluated/Staffed/Organized engineering and maintenance department for employer. Supervised construction and maintenance for 500 guestrooms, 5 restaurants, 2500 acres of gardens, 3 golf courses, 11 recreational lakes and all supporting utilities.

INTERNATIONAL TECHNICAL REPRESENTATIVE
IRECO INC
SALT LAKE CITY, UTAH

JANUARY 1971-AUGUST 1978

1. Widened/Strengthened/Conducted field studies and support activities for worldwide introduction of first cap sensitive composite explosive.
2. Transferred technology for and supervised construction of explosives factories in 10 countries, including Europe, Africa, and Asia Pacific.

MANAGER FIELD RESEARCH CENTER
IRECO, INC.
LEHI, UTAH

SEPTEMBER 1968-DECEMBER 1970

1. Managed/Organized/Systemized field research facility for development of innovative commercial explosive formulations and manufacturing processes.
2. Supervised design, fabrication and operation of several pilot plants.

U.S. CIVIL SERVICE, MUNITIONS TEST ENGINEER
FT. DOUGLAS
UTAH/EGLIN AIR FORCE BASE, FLORIDA

NOVEMBER 1965-AUGUST 1968

1. Designed/Constructed/Supervised complex testing procedures and facilities for high priority Defense Department programs in support of military operations in Southeast Asia.

COMMISSIONED OFFICER, U.S. ARMY CHEMICAL CORP
FT. MCCLELLAN
ALABAMA AND FT. DOUGLAS, UTAH

OCTOBER 1962-OCTOBER 1965

1. Administered/Organized various administrative and technical activities while serving as Aide de Camp to General Officer.
2. Top Secret Special Access Security Clearance.
3. Significant portion of duty consisted of dancing with wife of General who could not dance.

Easton D. (Deke) Blackburn, Sr., P.E., C.H.C.M., C.S.E.
2221 Thoroughbred Road
Henderson, NV 89015

Employment Experience:

2000-present
Sanders Construction, Inc. - Safety Risk Administrator

1989-2000
Frehner Construction Co., Inc. - Safety Administrator

1987-1988
Safety Director

1985-1997
Unit Manager

1969-1985
Safety Director

1961-1969
Production Supervisor

1961-12/1988
Titanium Metals Corporation of America - Henderson, Nevada
Metal Manufacturing

Education:

1950 Graduated from Valley High School, Orderville, Utah
1961 Associate Degree I Business Management, College of Southern Utah, Cedar City, Utah
1976 Associate Degree in Occupational Safety and Health, Clark County Community College, Las Vegas, Nevada

Professional Certificates:

Registered Professional Engineer (P.E.) - State of California #SF000800

Certified Hazardous Control Manager (C.H.C.M.), Master Level

Certified Safety Engineer, World Safety Organization #584

Other Courses Completed:

- Loss Control, University of Arizona, Tucson, Arizona
- IAIABC Workers' Compensation College, Portland, Oregon
- Advanced Safety Training, International Safety Academy, Houston, Texas
- Approved Instructor (Industry and Construction), United States Department of Labor
- Approved Instructor (Mine Safety and Health Administration. United States Department of Labor
- Industrial Safety Training Institute and Key Man Development Program, National Safety Council
- Risk Management Series, Clark County Community College
- Woodbadge, Boy Scouts of America, Boy Scout Leader W5-12-87-2
- Leadership Training, Career Track Inc.
- Rapport Leadership Training

Service/Professional Development:

- Volunteer in safety management instruction. Included involvement in professional development directed toward personnel who desired to upgrade/increase their safety knowledge.

- Lecturer for local ASSE meetings concerning Safety in the Titanium Industry. Subject matter included potential hazards, elimination of accidents and protection of workers.

Related Memberships/Activities:

- Board of Directors - Nevada Safety Council
- Governor's Advisory Board on Workers' Compensation
- Advisory Board - Clark County Community College
- Member - Industrial Hygiene Technical Training Advisory Committee
- Member - System Safety Society
- Member - National Safety Management Society
- Member - World Safety Organization

Chapter and Region Activities:

- Member - American Society of Safety Engineers (ASSE)
- Member - ASSE Management Committee
- Past President, Southern Nevada Chapter ASSE
- Past Chapter Vice President, Southern Nevada Chapter ASSE
- Member - Executive Committee, Southern Nevada Chapter (ASSE)
- Legislative Committee, Southern Nevada (ASSE)

Other Accomplishments:

- Witness, U.S. Federal Court. Testified on matters concerning specific hazards (chlorine gas and titanium dust) exposure before the OSHA Review Commission.
- Active Lobbyist. Involved in testimony before Assembly and Senate labor committees on Safety and Compensation matters for six consecutive sessions of the State of Nevada Legislation.
- Instructor/Lecturer - Clark County Community College, Safety Curriculum
- Qualified Instructor of Voluntary Compliance in Occupational Safety and Health
- ASSE Instructor for Accident Prevention
- Safety Professional of the Year - 1980, 3rd Annual Nevada Safety Congress
- Guest Speaker - All Ohio Safety Conference, Subject - The Nevada Industrial Commission Rehabilitation Program
- Guest Speaker - Regional Occupational Safety and Health Conference, Las Vegas, Nevada, conducted by the University of Arizona

Military Experience:

United States Army, 1954-1956 - Honorable Discharge

WESTERN STATES
DRILLING AND BLASTING, INC.

SEISMOGRAPH SPECIFICATIONS

EXAD-8
&
eXAD Vibration Analysis Tools Version 2 for Windows™

Operational Overview
The EXAD-8 and eXAD Vibration Analysis software is a combined hardware & software approach to recording and analyzing blast & construction vibration. The system is very powerful but is easy to use with just a little understanding of the eXAD system vocabulary. There are two main areas that will be discussed, EXAD-8 control and operations, and Analysis of EXAD-8 data on your computer.

The main steps for making a recording using the eXAD are simple, but very important. These include:

1. Configure the EXAD-8 system for recording vibration and sound. The basic configuration is to set the EXAD-8 for trigger mode, trigger source, trigger level, record time (this is how long the eXAD should record after triggering), sound measurement type (linear, and enter the ID#.

2. Remove the geophone (& geophone cable) and microphone from their storage locations. Connect the geophone to the eXAD-8 using the supplied cable (red connector) and place the geophone with the x axis pointing toward the blast. If possible, bury the geophone in the sub soil as this will provide the most accurate measurements. Remove the microphone from its strap and connect. Turn the system ON and check the battery voltage and the amount of available memory that you have remaining (this is in percentage of available memory). Return to Main Menu and Select **Measure** and press **ENT**. Select **Single or Continuous**, enter the **ID number** (identification number) and press **ENT**. Press ENT one more time to get to **Waiting for Trigger.** After the blast, note the measurements and press ESC until the Main Menu is displayed.

3. Connect the EXAD-8 to your computer using the supplied eXAD to PC serial cable. Start the eXAD software and switch on the EXAD-8. Enter any report information that you wish to have stored with each recording. Select **eXAD Control,** then select **Retrieve eXAD Data**. Enter the desired **Report Data**, and select the directory (**Data Path**) where you wish the data stored. Select the event or all events that you wish transferred.

4. After the data has been stored, your are now able to **Select** a **Record** (an EXAD-8 recording) and view that recording on the display by selecting **Vibration Analysis Tools** under **Analysis**. When you wish to print a complete report, select **eXAD Print** under **File operations**.

PC Hardware Requirements

Requirements Include:

- Hard Disk with 10 Mb Free
- Pentium or Higher
- Microsoft Windows 95 or Higher
- VGA or higher resolution screen supported by Microsoft Windows
- CD Rom
- Serial Port (or USB with USB to Serial Converter)

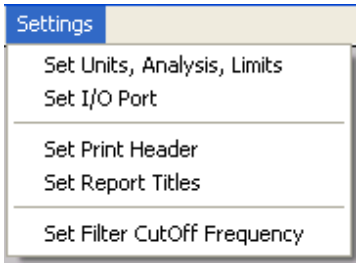
Installation

Insert CD containing eXAD Vibration Analysis Tools software.
From the Start Menu: Select Run , Browse to the CD Drive, and select Setup.exe

This will install all support files in the appropriate places on your hard disk, and create the Program Files\PMT\eXAD800 application directory, and Program Files\PMT\eXAD\DAT subdirectory, and install a sample data file (as used in the manual). Occasionally it will be necessary to exit from other running applications. **If the Microsoft Office toolbar is used, it is necessary to click on the toolbar and then stop running the application.**

Settings: eXAD Software

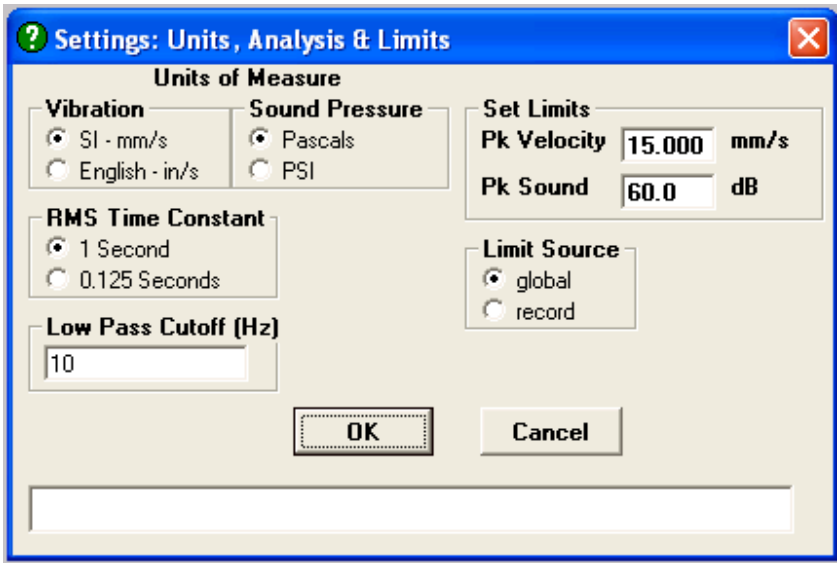
Custom Software Settings



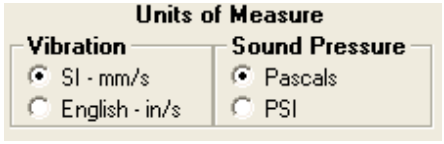
To properly use the eXAD software and provide for customized reports, the software **must** be configured. All configuration selections can be changed at any time. The Settings Choices are:

Set Units & Analysis

Two general groups of controls are displayed, Units of Measure and Analysis.



Units of Measure



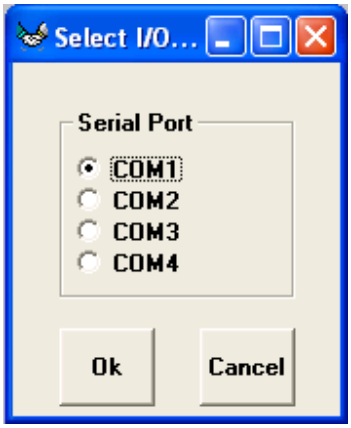
The Units of Measure group allows selection of the appropriate units for the area in which you are working. Specifically, units can be selected for vibration and sound pressure level. The choices depend on what is customary to use in your country, and any specifications against which you may compare. Please keep in mind that SI units are the international standard but can be directly converted to other systems.

Low Pass Cutoff (Hz) - This entry box allows the user to enter the low pass cutoff frequency. The cutoff frequency is specified in Hertz (Hz) and marks the -3db cutoff point.

RMS Time Constant (Hz) - In analysis where RMS vibration level is to be analyzed a selection should be made for the RMS time constant. In general the slow time constant is used (mainly for general vibration).

Set Limits – This allows vibration and peak sound pressure level limitation to be set.

Set I/O Ports



The choice made here is dependent on your PC hardware and how it is configured. The **Serial Port** is used for communication with the EXAD-8. The Serial Port choices are **COM1** to **COM4**. Almost all computers have at least COM1 available, and most have COM1 and COM2. Make sure that you select an available port. Check with your computer manual for the appropriate selection. Click on the appropriate selections and then click on the OK button.

Note: The EXAD-8 will not communicate properly with the computer while Hot Sync is active. Right mouse click on the Hot Sync icon and exit. This will reactivate when the computer restarts.

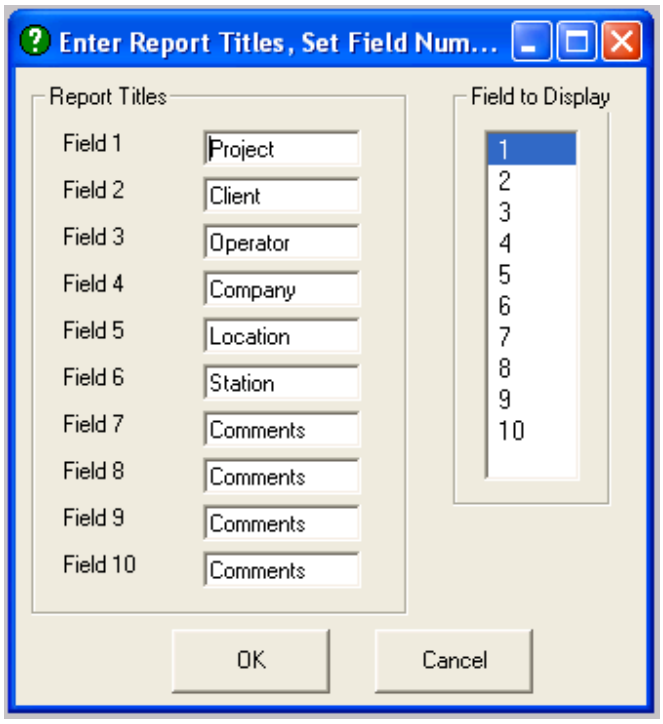
Set Print Header

This selection allows you to enter your company information that will be printed (centered) at the top of the first page of the formal report. Up to 48 characters for two lines can be entered. This will be printed at the top of page 1 of the report

Example: Physical Measurement Technologies
Keene, New Hampshire, USA

Enter Report Titles, Set Field Number

The eXAD software allows you to keep report information with each recording. The report data helps to identify the recording and any special information that is relevant. The report is comprised of 10 fields, including a title, and the report data. The report data will be printed on the first page (measurements page) of the formal report. Ten titles, of 10 characters each, can be entered.



This information is used to fully identify the report. Its use is not required by the eXAD software. The EXAD-8 has a facility for selecting an Identification Number which is stored with the recorded data in the instrument. That ID Number will be transferred with the data to the PC and stored in field number 6.

Field to Display
This allows the operator to select which field of the report data that will be displayed with each file (under Select Record) as a file identifier, and printed on each page of the formal report. If, for example, Project is Report Title number 1, and field number 1 is selected, the information that is entered in this field will be displayed when the list of files is displayed, and also printed on each page of the formal report.

Set Data Path

This is set under the File choice of the top menu bar (not under Configure). This tells the eXAD software where to put the data that is transferred from the eXAD system and where to find the data when you wish to analyze. A list of available directories is displayed. It is suggested that you use the DAT directory that was made under the installation data.

EXAD-8 Control and Configuration

To use the EXAD-8 for recording data, the instrument must be configured appropriately for the operations in which it will be used. The time and date should be set to local time. When it arrives, the EXAD-8 will be set to US Eastern time. Partial Configuration of the EXAD-8 can be performed through the EXAD-8 keyboard or the PC. Complete Configuration can only be performed through the PC. Retrieval of EXAD-8 stored data can only be performed using the PC. The EXAD-8 real time clock can be set through the PC or EXAD-8 keyboard.

EXAD-8 to PC Serial Communications

Communication between the EXAD-8 and the PC is under software control, and is really very simple. Connect the eXAD to PC serial cable, to the PC COM (serial) port which was selected under Configuration, and to the **Serial I/O** connector on the EXAD-8. This is the hardware link between your EXAD-8 and PC. The PC end of the cable is a 9 pin female connector. This has become the standard, particularly for notebook PC serial connectors. If your PC has a 25 pin serial connector, a 25 pin to 9 pin adapter can be purchased at any personal computer or electronics store. The EXAD-8 end of the cable is a 9 pin male connector. Normally, the connection should be made with the EXAD-8 switched into the Off position and the PC turned off.

After the connection has been made, switch the PC on and start the eXAD software. Switch the EXAD-8 to the On position. Watch the EXAD-8 display until the Main Menu is visible. **Any PC to EXAD-8 Communications can only be made when the EXAD-8 Main Menu is Visible**. In the eXAD software, select **eXAD Control**, click on **eXAD Communications**. This will take you to the eXAD Communications program. Select **eXAD Control**. The choices are:

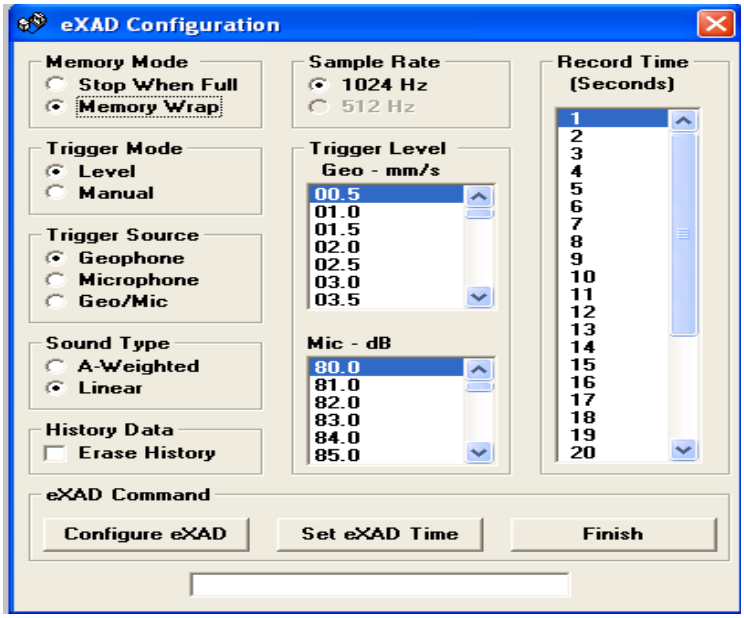
Configure eXAD
Retrieve eXAD Data

Configure eXAD

Configuration of the EXAD-8 consists of setting its operating parameters. Those can be set either through the EXAD-8 keyboard or through the PC. Partial configuration is allowed through the EXAD-8 keyboard, while a complete configuration can only be accomplished through the PC.

Very Important: Configuring the EXAD-8 through the PC will clear the EXAD-8 memory of stored events. Make sure that any events that you wish to save were Retrieved before configuring.

When the Configure eXAD selection is made, a window will open which shows the operating parameters and their choices. The configuration elements or operating parameters, and how the configuration can be made, are listed as follows:



Parameter	EXAD-8	PC
Memory Mode		X
Sample Rate	X	X
Trigger Mode	X	X
Trigger Level	X	X
Record Time	X	X (When Memory Mode is Stop When Full)
Time & Date	X	X

If using the keyboard, press the Tab key to move to the appropriate selections, and then send the configuration to the EXAD-8 by selecting the displayed **Configure eXAD** button. The configuration elements are described as follows:

Memory Mode
The choices are:

Stop When Full
Memory Wrap

This controls how the EXAD-8 handles the data it stores. The EXAD-8 has a storage capacity of 100 full waveform events (1 second length) and 500 history events. This means that it will store up to a total of 100 full records of vibration and sound data and 500 sets of peak particle velocity and peak sound pressure measurements (History). As the record length is increased, the number of available full waveform events decreases proportionately. If the EXAD-8 was configured to **Stop When Full**, when the memory is full, the EXAD-8 will not allow any further recordings until the data has been transferred and the unit was reconfigured to clear the memory. If the EXAD-8 was configured to **Memory Wrap**, then when the memory has been filled, the oldest recording will be overwritten by the newest recording. The Memory Mode can only be changed through the eXAD software running on the PC.

Suggestion: Operate in Stop When Full Memory Mode. This will ensure that the full waveform data will not be lost without the chance to offload the previously stored data.

Sample Rate
The Sample Rate Selections are:

1024 Hz
512 Hz

The eXAD-8, although storing at 1024 samples per second has an equivalent sampling rate of over 25,000 samples per second per channel (re measurement of peaks). The sample rate and cutoff frequency is selected based on the range of vibration frequencies in which you are interested. The current version of software and eXAD-8 firmware only allows a sampling rate of 1024 samples per second per channel. Future versions will allow many more options.

Trigger Mode
The Trigger Mode choices are:

***Leve*l**
The selection allows the EXAD-8 to start recording based on a level, or threshold, of vibration and/or sound pressure levels. If the Level mode is selected, you must configure a trigger level for the geophone and/or microphone..

Manual
The Trigger Mode is how the EXAD-8 determines when to start recording. As an example, if the Trigger Mode is configured as Manual, the EXAD-8 will only start recording when the ENT key on the keyboard is pressed. This allows control of exactly when the EXAD-8 starts recording.

Trigger Source
When the Level trigger mode is selected, the eXAD-8 uses the trigger source and trigger level to determine when to begin recording. As an example, for a trigger source of geophone and a trigger level of 0.5 mm/s (0.02 in/s) the eXAD-8 will wait until the vibration level reaches 0.5 mm/s (0.02 in/s) before beginning to record. It is important to set the trigger to a level sufficiently high to avoid false triggers (from nearby construction activities, etc.) and low enough to ensure capturing of the vibration of interest.

Record Time
The Record Time selection allows you to configure the EXAD-8 to record for a length of time after the unit triggers. The maximum allowable record time for a single recording is 30 seconds. Set to record time long enough to capture the vibration and overpressure related to a blast.

Suggestion: Knowing the duration of the blast and the distance from the blast, the record time can be correctly set. Add 1 second to the blast duration and then add one second for each 300 meters (1000 feet) from the blast.

Sound Type
A-Weight
A-Weighted is selected for the evaluation of sound levels associated with human hearing.

Linear
Linear is selected for the evaluation of blasting induced overpressures.

Erase History
The eXAD retains the peak measurements from the last 100 events (triggers) and escape from triggers in the history buffer. When the **Erase History** box is checked, the History buffer will be erased.

Suggestion: Download and retain the history data on an occasional basis. Erase the history at the beginning of the season.

Configure eXAD
When the desired changes have been made to the configuration, it is time to send this information to the EXAD-8. By clicking on the Configure eXAD button will open a window warning that the memory (full waveform only unless Erase History is checked) will be erased. Press the OK button to transmit the configuration via the serial port to the EXAD-8. A short message should appear on the PC display (**eXAD Communications Open**). At the same time, a message will appear on the EXAD-8 display, **Communicating with PC**. When the data has been

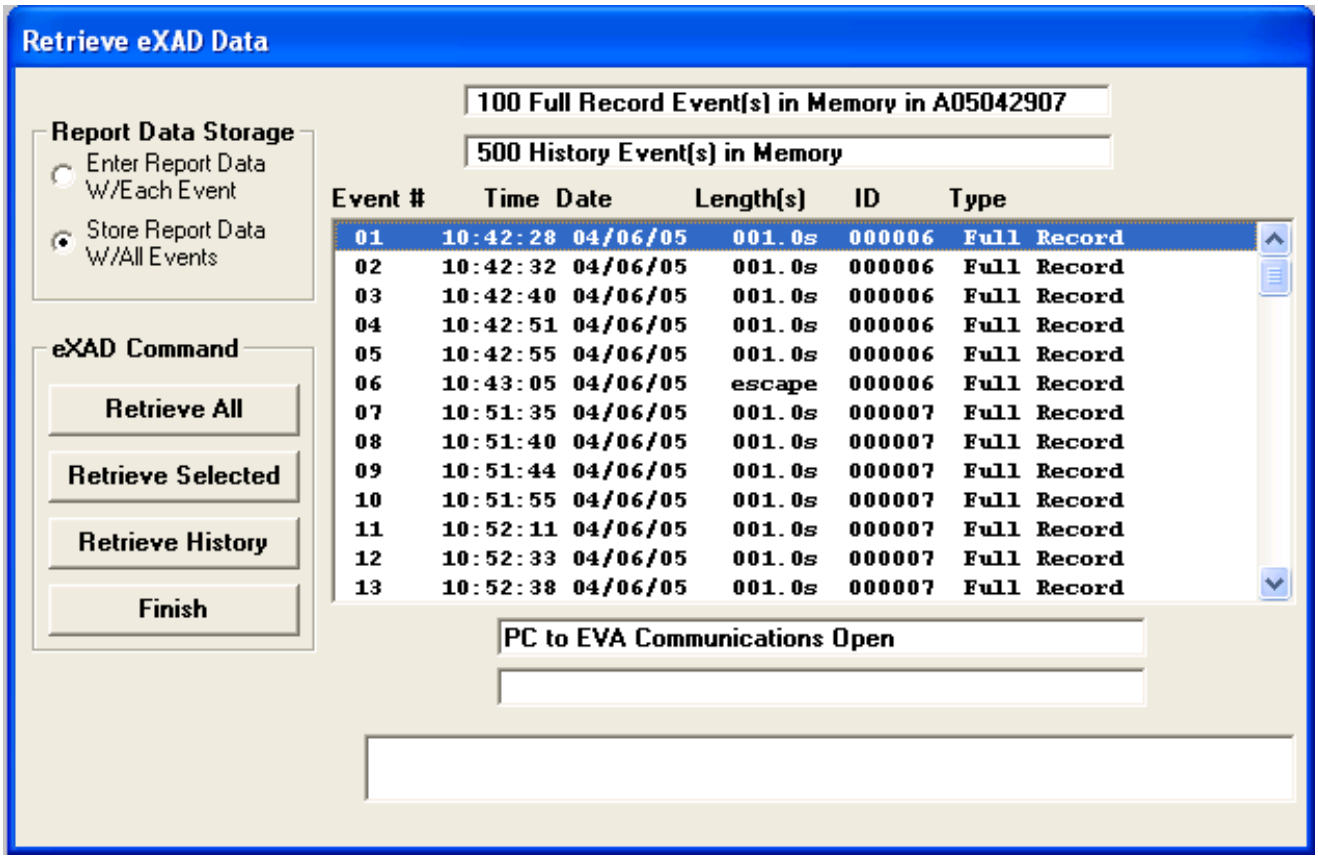
transmitted, the message will disappear from the PC display, and the EXAD-8 will restart with the new configuration. A success message will be displayed if the transfer was completed without problems.

Remember: Configuring the EXAD-8 through the PC will clear the EXAD-8 memory of stored events. Make sure that any events that you wish to save were Retrieved before configuring. The eXAD units of measure (mm/s or in/s) will be configured as the current PC software setting.

Suggestion: Watch the EXAD-8 display to verify that communications were completed. If there were any type of communications failure, it is possible that the **Communicating with PC** message will remain on the display. This means that the unit is still waiting for the end of the data. (It did not receive all of the data that it needs to configure). Should this happen, switch off and then restart the EXAD-8, check all connections, and go back to Configure eXAD.

Set eXAD Time & Date
This selection sends the time & date which is currently set in your PC. The time & date is very important to the EXAD-8 since all data files are time stamped, and the eXAD software uses the time stamp to create file names for the data that is transferred from the EXAD-8.

Retrieve eXAD Data
This selection is used to transfer data which has been stored in the EXAD-8 to the PC. The EXAD-8 and the PC must be connected by the EXAD-8 to PC serial cable. When this selection is made, the eXAD software communicates with the EXAD-8 and determines how many events are stored. It then displays a list of the events stored, the trigger time and date for each recording, and the length in seconds of each recording. To transfer, it is necessary to select either **Retrieve All**, **Retrieve Selected**, or **Retrieve History** under **eXAD Command**. Retrieve All is selected to transfer all events stored in memory. **Retrieve Selected** allows the user to transfer the highlighted event. (Use the up and down arrows or click with the mouse to highlight the desired event, then double click). The example below indicates that there are 100 events in memory. Additionally, there are 500 History Events in the eXAD-8 memory.



Two **Report Storage** options are available. They are:

Enter Report Data With Each Event
This selection forces the software to stop before the transfer of each recording to allow the user to enter Report Data.

Store Report Data With All Events
When this selection is made, the system allows the input of the Report Data before the first recording and then stores that data with all transferred recordings.

Retrieve All
When selected, all full record events are transferred from the eXAD-8 to the selected path on the computer.

Retrieve Selected
This option allows the user to transfer events that have been previously selected without having to transfer all events. To select an event, double click on each desired recording. This will place a double arrow marker next to that specific event. Then click on the Retrieve Selected button.

The Report form will open allowing the operator to enter information that will be archived with the record. After the Report Data has been accepted, the current data path is displayed. The user can then direct the data to any available directory. File names for the data files will be created automatically from the trigger time & date, and the EXAD-8 serial number. (The trigger time & date, is the time & date that the EXAD-8 triggered to record that particular event.) When the transfer is completed, click on the Finish button to end Communications between the PC and the EXAD-8.

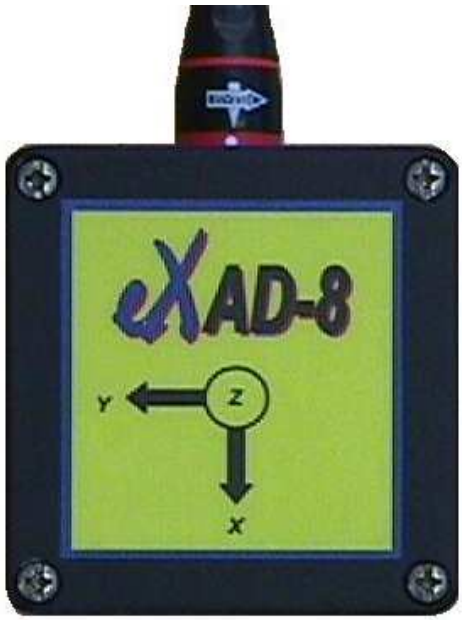
Note: When the data is retrieved, the EXAD-8 memory is not cleared. If there is a communication failure for any reason, the process can be repeated. If you have previously transferred this particular data from the EXAD-8, that data will be overwritten.

Suggestion: Verify that the recordings have been transferred properly by viewing the data graphically before clearing the memory of the EXAD-8. The memory should be cleared before next use of the system. It is best to clear the memory by reconfiguring the EXAD-8 using the PC

Retrieve History
The selection of Retrieve History transfers all stored events into a text file (named with the serial number) and also displays the history list.

EXAD-8 Operations

EXAD-8 Components
The EXAD-8 is a high accuracy vibration and sound pressure and sound level recorder, that has been designed specifically to record blast and construction induced vibration & sound. The basic components of the system are the triaxial geophone unit, microphone, internal electronics (digital & analog), liquid crystal display, 4 key keypad, Start/Stop switch, and battery. The system was designed to be reliable & rugged, but it is a high sensitivity measuring instrument and caution must be exercised. **Note: It is not necessary to take your PC into the field for eXAD operations**.



Triaxial Geophone Package

The triaxial geophone is the velocity (vibration) sensing part of the EXAD-8 system. It is stored on the left side of the keyboard plate. The electrical connection is made through the PMT cable and connector. Handle the geophone with care. **Damage can result if the package is dropped. The geophone package should only be opened by factory trained personnel.**

Axes of Sensitivity
The axes of sensitivity for the geophone package are called the X, Y, & Z axes. The X axis should be pointed toward the blast and Z is vertical. The geophone should be placed in the earth level to within +/- 10 degrees. Note: the X axis is sometimes called radial or longitudinal. The Y axis is sometimes called transverse. The Z axis is sometimes call vertical.

Microphone
The microphone is stored in the lid of the eXAD with a Velcro strap. It is attached to the EXAD-8 system by a cable (about 2 m), through the Mic connector on the top plate. The sound channel is designed to measure both air overpressures associated with blasting (Linear) and A-weighted, fast response, true RMS sound levels (A-Weight). This allows the EXAD-8 to record sound levels which are equivalent to what and how the human ear responds to noise.

Electronics
The internal electronics are low power CMOS circuitry and should not be handled by anyone other than factory, or factory approved, personnel. Be careful to avoid static discharges as damage could result. All signal conditioning and digital electronics are within the EXAD-8.

Liquid Crystal Display (LCD)
The EXAD-8 LCD is 4 lines by 20 characters, and with the keypad, provides the user interface while operating in the field. Never drop anything on to, or press on, the LCD, since it can be damaged.

KeyPad
The 4 key keypad allows the EXAD-8 system to be configured while operating in the field. A PC is not necessary to operate the EXAD-8 or change necessary operating parameters.

Battery & Charger
The battery is a 6 volt lead-acid gel-cel. Normal continuous operating time for the EXAD-8 is between 80 and 100 hours depending on temperature and age. The battery should never be allowed to discharge to below 5 volts, since battery life will be reduced. If it is allowed to discharge down below 4.5 volts, it may never recover even with charging, and will have to be replaced. Always charge the battery after use to a full charge. The supplied battery charger is the universal voltage type. The connector power jack is on the top plate of the EXAD-8. **Always charge the battery with the lid fully opened, and the EXAD-8 switched to the Off position**.

Switch the EXAD-8 to the off position, when not in use. Over discharging will damage the internal battery.

Operating the EXAD-8

Operating the EXAD-8 is very easy, but it is important to develop and follow a methodology or procedure which can be repeated exactly. In this way, measurements and results will be far more consistent. The purposes of measuring blasting induced vibration and sound include; accurate determination of vibration levels for compliance/insurance purposes, and design of blasts for maximum efficiency and minimization of vibration levels. Therefore, it is very important that the “how vibration is measured” , be standardized and repeated.

Placing the EXAD-8 (Blast)
When measuring for blast induced vibration, it is recommended that the EXAD-8 be placed adjacent to the structure of concern. It is always best to bury the geophone in the subsoil. This will improve consistency of measurements, minimize measured vibration levels, and will be more representative of the vibration induced at the structure.

Operating

Remove the geophone from its storage compartment and the geophone cable from its storage location. Connect the cable to the geophone and to the red connector on the right side of the eXAD-8 case. Remove the microphone and microphone holder from their storage locations. Insert the microphone holder into the socket on the right side of the case and microphone into the loop. Attach the microphone cable to the black connector.

Note: Cables and connectors are probably the most problematic part of any field instrument. It is important to keep the connectors clean. Handle them with care!

Switch the EXAD-8 to the On position and watch the display. Verify that the battery voltage is within acceptable limits. Also verify that the EXAD-8 time and date is correct. This is very important since file names and time stamps use the time and date. If it is incorrect, reset the time and date. The number of events recorded and the percentage of available memory, will then be displayed. Verify that there is sufficient memory to make your recording. The EXAD-8 configuration will then be displayed, including: Record Length in seconds (how long the EXAD-8 will record after it triggers), the Trigger Mode (Manual or Level), the Memory Mode (Stop or Wrap), and Sample Rate. Make sure that the Record Length is long enough to record the entire blast duration and the late arriving overpressure. If required, change the record length using the keypad. The Memory Mode and Sample Rate can only be changed using the eXAD software and PC. The Main Menu will now appear. Selections from the Main Menu are made by using the up↑ and down ↓ arrows and pressing the ENT key. Assuming that the geophone and microphone have been connected select TEST from the main menu. Then select SENSOR. This will dynamically test the geophone. The results of the geophone test will then be displayed. Pass indicates that the system is working properly. Fail indicates a problem. Check cable connections and geophone level, then retest.

MAIN MENU

MEASURE
REVIEW
CONFIGURE
TEST

Press the up or down arrows on the keyboard, and press **ENT** to select.

MEASURE
When it has been verified that the EXAD-8 is configured properly, a vibration recording can be made. Selecting **MEASURE** displays:

SINGLE
CONTINUOUS
REAL TIME

SINGLE
Selecting SINGLE allows the instrument to trigger and record a single event. After triggering, the peak measurements for each of the channels will be displayed. Selecting ENT will allow the instrument to trigger again. Selecting ESC will return to the Main Menu.

CONTINUOUS
Selecting CONTINUOUS allows the instrument to trigger, display the peak measurements and then immediately return to **WAITING** for a trigger.

After selecting either **SINGLE** or **CONTINUOUS** the display will indicate:

Set ID#

Set ID#
This is used to enter an identifier number for the recording. An example ID# would be the station or building number where the instrument is deployed. The ID# is selected by using the up and down arrows and pressing ENT to accept the displayed number. If the current entry is correct then select the ESC key to display the next screen. The ID# will be stored with field number 6 of the Report Data. It is a good idea to use this feature to keep track of your recordings.

After pressing the ENT key,

RECORD EVENT

PRESS ENT TO BEGIN
PRESS ESC TO EXIT

will be displayed.

After pressing the ENT key

WAITING

PRESS ESC TO EXIT

will be displayed. When the vibration and/or sound pressure reaches the trigger level the message RECORDING will be displayed. If in MANUAL trigger mode pressing the ENT key will initiate recording. After recording and storing the data the peak measurements will be displayed.

X= 12.5 mm/s 04-08-05
Y= 12.5 mm/s 10:57:05
Z= 12.5 mm/s MI=117dB

ENT/ RECORD ESC/EXIT

In English units:

X (R) = 0.50 in/s 04-08-05
Y (T) = 0.50 in/s 10:57:05
Z (V) = 0.50 in/s MI=117dB

ENT/ RECORD ESC/EXIT

The measurements displayed are the peak velocity for each channel, and the peak sound pressure level in decibels. Additionally the date (mm-dd-yy) and time of the trigger are displayed.

Note: The "peak particle velocity" that is reported is the greatest of the three channels.

The peak measurements are stored in the unit history (available under REVIEW).
If finished, press the ESC key to return to the Main Menu. The data is stored in non-volatile memory and the EXAD-8 can be switched to the Off position. **Always turn off the EXAD-8 from the Main Menu. Data files can be corrupted by switching the EXAD-8 off from any other than the Main Menu.**

REVIEW
Selecting REVIEW displays the peak measurements for all history events stored in memory (to as many as 500). Press ENT to review the next older set of measurements. The most recent measurements will be displayed first.

CONFIGURE
The Configure selection displays the menu:

CONFIGURE
SET OPERATIONS
SET TIME & DATE
CLEAR MEMORY

SET OPERATIONS
Selecting **Set Operations** allows you to change the EXAD-8 configuration without the PC. The first message to be displayed will be

SET UNITS OF MEASURE

ENGLISH
SI

Selecting **ENGLISH** will provide vibration measurements in units of in/s while **SI** will provide vibration measurements in units of mm/s. After selecting, the **SOUND RESPONSE** selections are displayed.

SET SOUND RESPONSE

LINEAR
A-WEIGHTED

Linear would normally be selected when measuring air overpressures, while **A-Weight** is selected for the measurement of sound levels. After selecting, the SET RECORD TIME window is displayed.

SET RECORD TIME

1 SECOND(S)

The **SET RECORD TIME** menu offers the ability to change the record time (time after trigger) from 1 to 30 seconds in 1 second increments. Change with the up and down arrows and press ENT to select. After selecting the **TRIGGER MODE** window is displayed.

SET TRIGGER MODE

MANUAL
LEVEL

MANUAL trigger is normally selected when the operator wishes to begin recording on command (pressing the **ENT** key while **WAITING FOR TRIGGER**). **LEVEL** trigger is selected when the operator wishes to have the instrument begin recording based on the trigger threshold of vibration and/or sound. If **LEVEL** was selected, then a choice of trigger source is displayed. The choices are:

GEOPHONE
MICROPHONE
GEO/MIC

The choice of **GEOPHONE** allows selection from 0.3 mm/s to 25.0 mm/s in 0.1 mm/s increments. In English units 0.01 in/s to 1.00 in/s, in 0.01 in/s increments.

The choice of **MICROPHONE** (linear) offers trigger levels ranging from 80 to 120 dB in 1 dB increments.

Suggestion: A geophone trigger level of 1.3 mm/s (0.05 in/s) has been found to be a good working geophone trigger level. If using a microphone trigger level it is suggested that it be greater than 110 dB

Set Date & Time

The set date & time window will be displayed.

SET DATE & TIME

DATE	TIME
MM-DD-YY	HH:MM:SS
01- -	- -

Use the up and down arrows to change the month to the appropriate month and press the ENT key. Repeat for Day (DD), Year (YY), Hour (HH), Minute (MM), Second (SS). Just pressing the ENT key will accept the present values.

Clear Memory

This selection allows the user to empty the EXAD-8 memory without resetting through a PC. To clear the memory it is necessary to confirm by selecting **YES**. It is best to clear the memory of the EXAD-8 by resetting the instrument using the PC (eXAD Communications: Configure eXAD/MMC). This will reset all internal variables.

TEST

SENSOR

The TEST selection on the main menu allows the operator to test the geophone and the battery. If testing the geophone and a failure message is displayed, verify the cable connections and the level of the geophone.

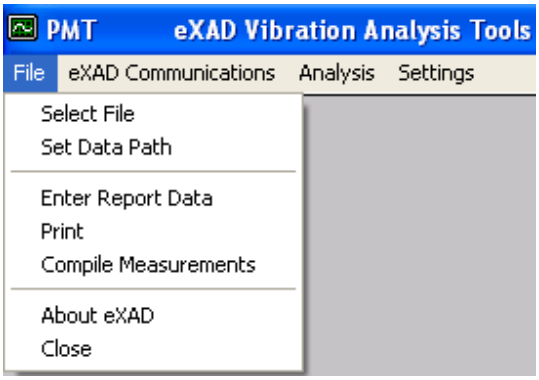
BATTERY

This selection displays the present battery voltage. **A recharge warning will be displayed if below 5.2 volts. If the battery voltage drops below 5 volts, the eXAD will not allow further operations until the battery has been recharged.**

eXAD Software Vibration Analysis Tools

The eXAD software Vibration Analysis Tools is a powerful suite of tools designed to archive, analyze, and print blasting induced vibration and sound records specifically recorded with the EXAD-8 system. The tools allow you to display the acceleration (x,y, & z channels) (waveforms) and sound level (dB(A)) time histories. It also allows various levels of manipulation and control so that you can Expand and Zoom the time histories, scroll through the data, and time locate specific areas of interest.
Before starting the Vibration Analysis Tools it is necessary to select an event or recording to analyze. Choose the File selection from the top Menu Bar.

FILE



The selections are Select File, Set Data Path, Enter Report Data, Print, and Compile Measurements.

Select File
This selection allows you to choose an event to analyze. A list of files will be displayed along with the trigger time & date, and the Report Data field (15 characters) which had been selected. Highlight the event of interest and press Enter or click on the OK button. **This record will become the current event. It will remain the current event until a new record is selected or you exit the software.** After you have selected a record you can add or edit the Report Data or display the analysis.

Set Data Path
This allows selection of available directories in which to store or select data.

Enter Report Data
Once a record has been selected, text information can be stored with each report. There are 10 fields with the Titles that were entered when the eXAD software was configured. (The titles can be changed after selecting the recording for storage with the recording.)

Suggestion: Include report information that will help identify the record when you have long forgotten what and why. It is good practice to enter common Report Data before transferring to the PC.

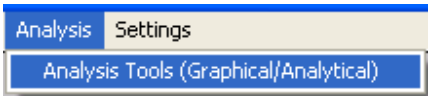
PRINT
This choice allows the selection of one or multiple files to print. Double click on the files that you wish to print then click on OK to send the files to the system printer.

Compile Measurements
This allows the measurements from multiple files to be compiled into a text file that can be imported into a spreadsheet or data base. Operations are similar to printing except a file will be created. The file name must be entered to create the text file.

About eXAD
This displays the copyright information and the software version.

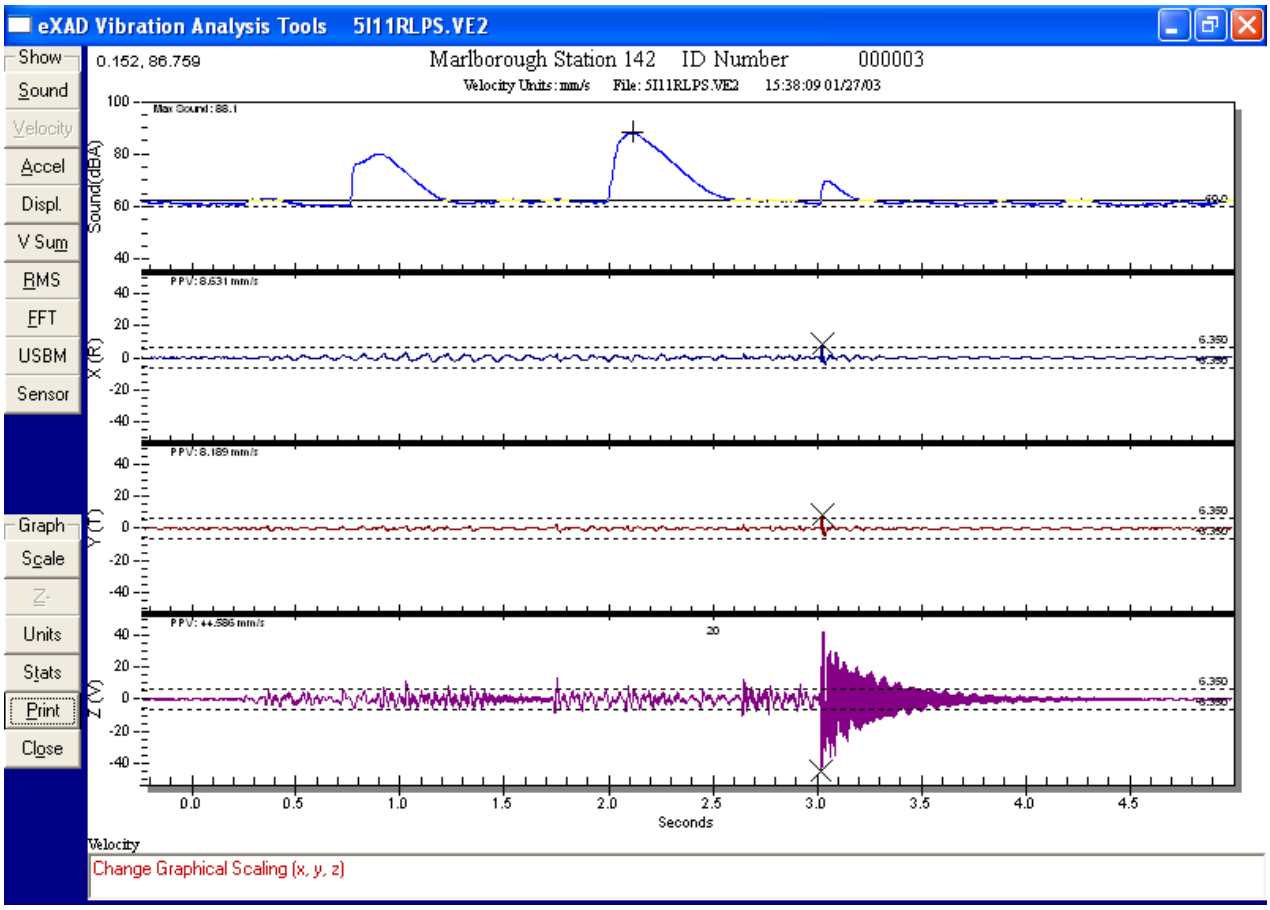
Close
This end the program.

eXAD Vibration Analysis Tools



Once a file has been selected, the Analysis Tools can be used to graphically display, analyze, and print the data. Choose Analysis from the top Menu Bar. Press Enter or click on Vibration Analysis Tools.

The graphics screen (Figure 1) is divided into 4 graphics windows. The top window is used for displaying the Sound Level time history and the 3 axes of vibration are displayed in the bottom 3 windows (X,Y,Z) for extended analyses. At this point the graphics screen will be drawn. The current event data will be loaded and drawn on the display (See Figure 1). Once the data has been displayed all of the tools are available. The available commands are listed on the command bar on the left edge.

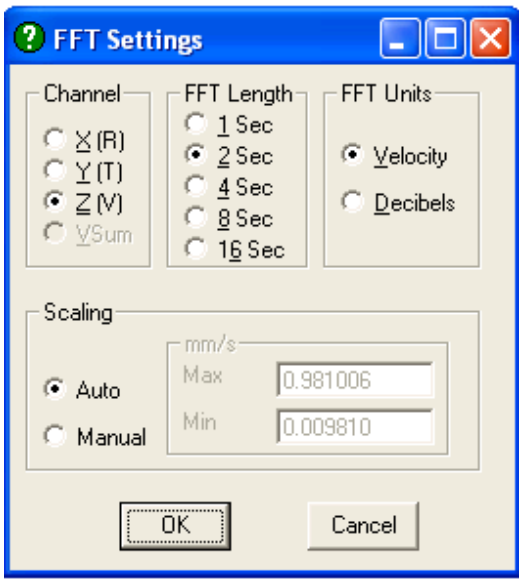


Command Bar Definitions

Sound - Display Sound Level Time History in Top Window
Vel. - Display Velocity Time Histories (default on start-up)
Accel. - Calculates (from the velocity time histories) and displays motion in terms of acceleration (milli(g)s)
Displ. - Calculates (from the velocity time histories) and displays motion in terms of displacement (mm or in)
V Sum - Display Vector Sum Time History in Top Window of User Selected Channels
RMS - Display Root Mean Square Time Histories of All Channels (x,y,z)
FFT - Display Fast Fourier Transform of User Selected Data. Place Cursor Bar at position of interest, Click on FFT, Select Channel, Select length of section to analyze (Spectral Analysis)
Scale - Controls Visual Scale
Z- Undo Zoom - You can zoom on a section of the time history by moving the mouse cursor to the point of interest and holding the left mouse button down while dragging and creating a zoom box. Select the Z- button to return to a normal display.
manual - With this switch on, the scaling can be manually controlled by the operator.
Units - Set Units of Measure from Within Graphics Display (The data will be re-calculated & re-drawn)
Stats - Statistics (Measurements) Displays Measurements, Performance Measurements, and Analysis. The Page can be printed or closed. (**See Sample Report at back of Manual**)
Print - Print the Graphics to the System Printer
Close - Close Vibration Analysis Tools Data Display

FFT (Fast Fourier Transform)
The FFT is an extremely powerful trouble shooting tool which provides amplitude and frequency information about the vibration of interest. This is particularly useful for vibration resulting from a repeating or cyclical source

To utilize the FFT, **move the cursor bar to the beginning of the section of interest** and select the FFT button. Move the mouse cursor to the point of interest and when the cursor changes to a hand, click with the left mouse button. This will place the vertical cursor bar at that location. The FFT is used to analyze the vibration beginning at that point.

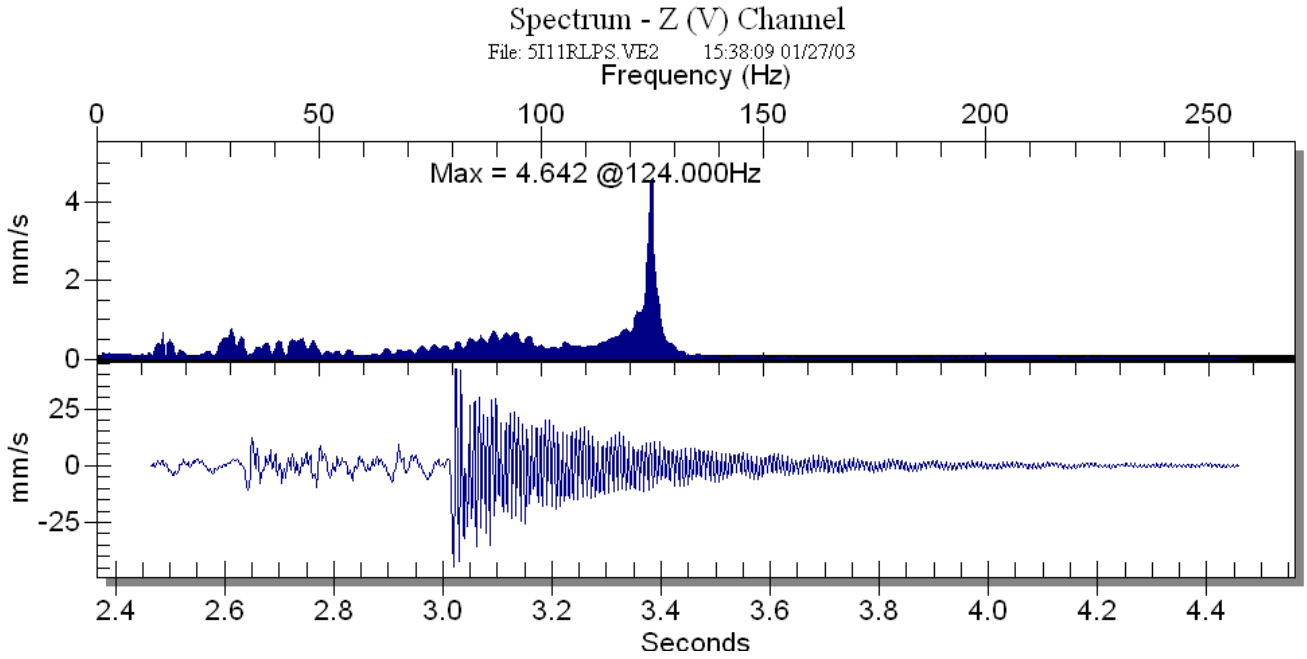


Select the Channel and FFT Duration (Click on OK)

Note that selecting a longer FFT Length provides increased frequency resolution but analyzes a longer section of data.

FFT Display

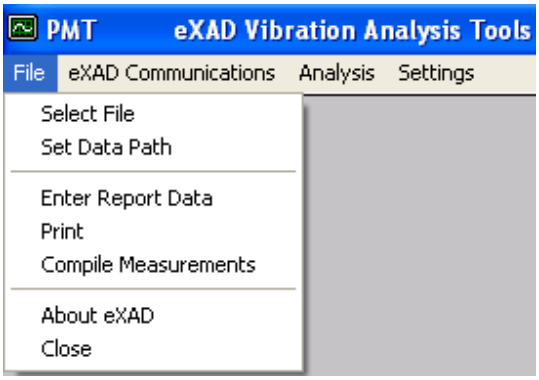
The resulting FFT page presents an analysis (upper window)of that section of the z axis (lower window) channel time history. The analysis, or spectrum offers a presentation of vibration level versus frequency. The spectrum below shows significant vibration level at various frequencies. The dominant frequency on the graphs below is at 124 Hz.



Printing and Output eXAD Data

There are several methods for printing or outputting eXAD data for presentation or analysis purposes. The most common approach is to print individual reports for each recording.

Printing



The eXAD software provides three methods of printing.
A quick screen print can be performed from the Vibration Analysis Tools graphics display by clicking on the Print button.
The Stats (statistics) page can be displayed from the graphics display.
The more formal method is to select **eXAD Print** from the File menu on the top menu bar.

After selecting Print, the directory list will open. Select the record to be printed by double clicking on the record of interest, or highlighting and pressing the S key.

International Blasting Services
Marlborough, NH USA

Record Analysis

File Name:	6L1SCALF.VE2	eXAD-8 Serial Number:	A04042829
Trigger Time:	07:37:43	Firmware Version:	1.0
Trigger Date:	04/12/05	Record Length:	5s
Monitor Start Time:	07:37:40	Cutoff Frequency:	256 Hz
Monitor Start Date:	04/12/05		
Software Version:	.54.0.1		

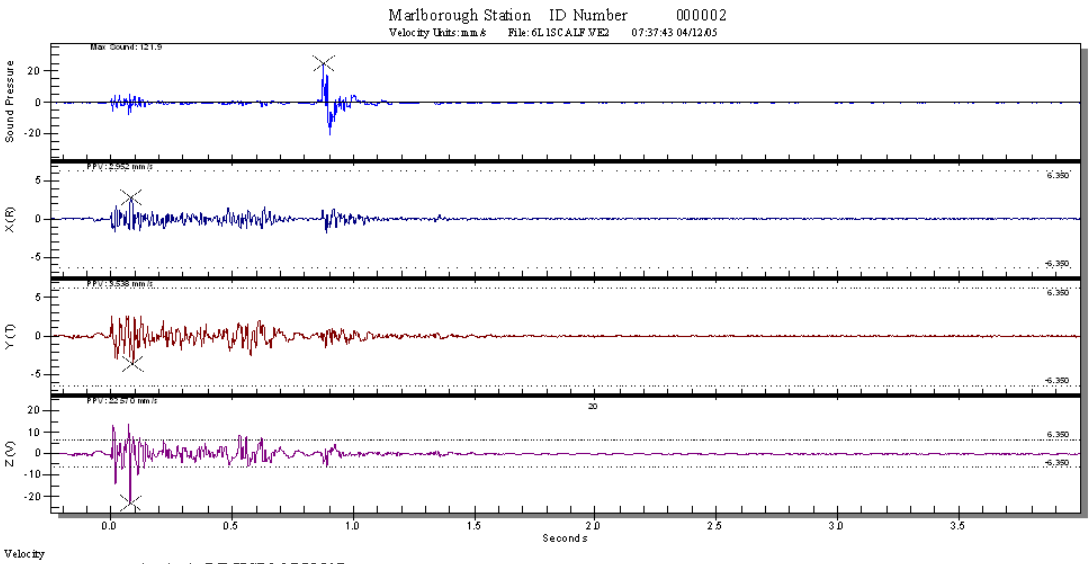
Measurements

Vibration Analysis	X (R)	Y (T)	Z (V)
PPV - Max 0 to Peak (mm/s)	2.952	3.538	22.570
Time of Peak (s)	0.085	0.092	0.081
ZC Frequency at Peak (Hz)	39.4	46.5	64.0
Peak Vector Sum (mm/s)	22.708 @80ms		
Max Acceleration (milli(g)s)	64.765	88.779	537.407
Max Displacement (mm)	0.013	0.019	0.093

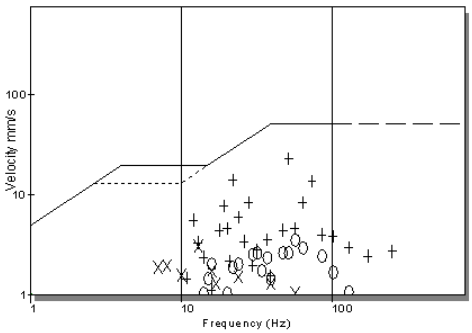
Sound Pressure Analysis	
Max dB (PA)	121.9 (24.9200)

Description

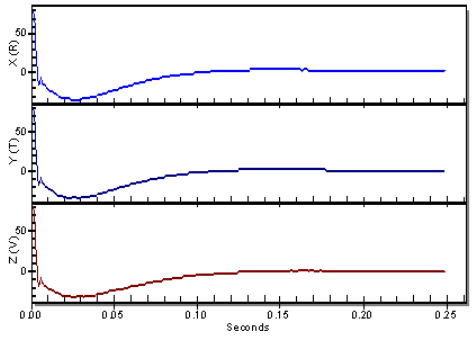
Project	Marlborough Quarry
Client	New Hampshire D & B
Operator	G.P. Lorsbach
Company	PMT, Inc.
Location	Marlborough Station
ID Number	000002
Conditions	T=0F, Wind From NW @20
Comments	Sample Data
Distance	500 Feet
Comments	



Analysis RE USBM RI8507



Sensor Test Data



The Worlds Standard of Measurement . . .
Blast, Construction, Structural Vibration & Sound

Physical Measurement Technologies, Inc., introduces the eXAD-8 seismograph and eXAD Vibration/Sound Analysis Tools software as the new standard in motion and sound measurement. Utilizing our entirely new eXPeak architecture, the eXAD-8 is designed to eliminate the inaccuracies associated with existing older seismograph designs. The eXAD-8 system was created to measure, analyze, and document blast/construction/structural vibration and sound, absolutely, easily, and at a **very low cost!**

Design Concept Overview – The eXad-8 system is a data collection system that is designed to overcome the inherent weaknesses associated with traditional sampling seismographs. PMT has created a new combined analog/digital concept that ensures that peak measurements are captured accurately and are repeatable. All standard sampling seismographs have the same problem; **repeatability**. Specifically, when two seismographs are placed side by side in a field situation, the **difference in the peak measurements can be as much as 100%**. However, when placed on a shake table, seismographs will generally be within 5% of each other. **This is a problem!**

PMT has solved these problems by creating the unique eXPeak architecture. This is an entirely new synthesis of analog & digital electronics, and steep slope anti-aliasing filters. The system tracks and stores the signal between samples and eliminates high frequencies that have no effect on structural damage. This new approach provides better than 95% coverage (960 out of every 1000 microseconds) and an equivalent sampling rate of greater than 20,000 samples per second. This is truly an amazing feat! **Accuracy is not compromised!**

High Accuracy Vibration and Sound Measurement, at Low Cost - The eXAD system is designed to be highly accurate in the short and long term. The system architecture (Division of Data Collection & Analysis/Printing) ensures against obsolescence and reduces costs. By separating the data analysis from the instrument, software upgrades keep the system current, and on the leading edge of vibration analysis. PMT is committed to continuous improvement and minimal cost. PMT will provide **technical support and software upgrades at no charge!**

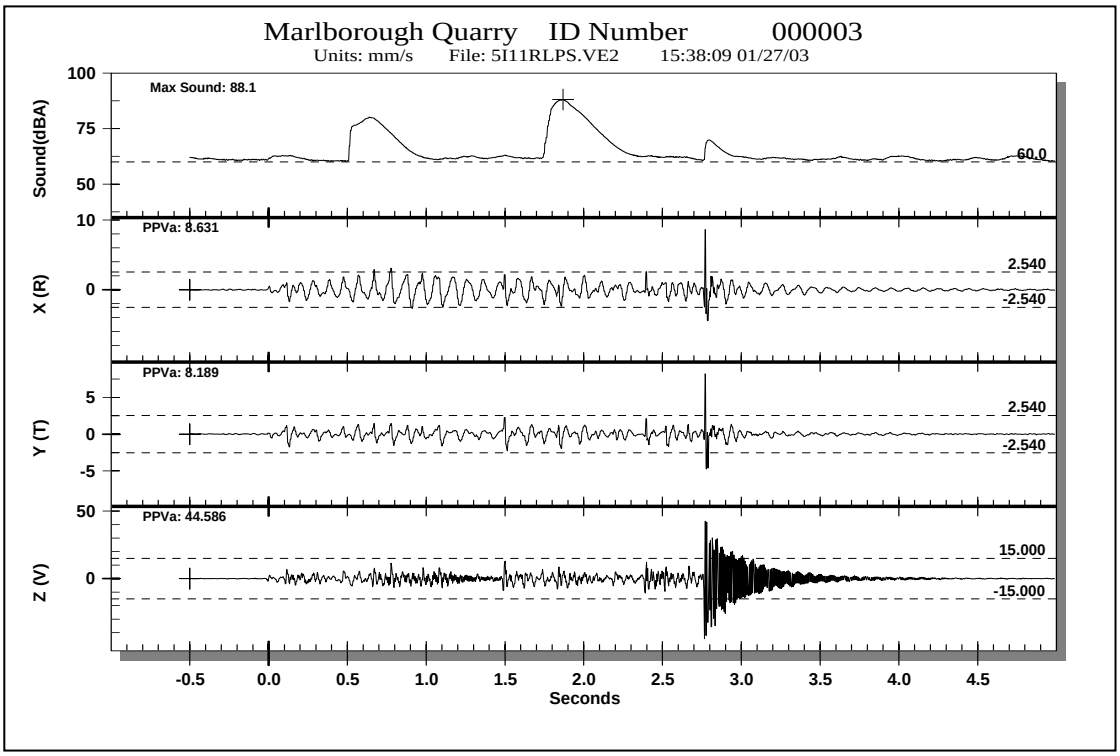
PMT

Physical Measurement Technologies, Inc.
P.O. Box 400, 4 Ling Street
Marlborough, NH 03455 USA
Voice: 603.876.9990
Fax: 603.876.9995

World Standard in High Accuracy Vibration & Sound Measurement

Field Operations with a Field Tough Instrument - The *eX*AD system is particularly easy to operate, both in the field and in the office. About the size of a notebook computer; operation is simple and fast. The system can be configured for use on-site, without having to carry a PC with you. Simply connect the geophone and microphone, turn it on and select monitor. The data is automatically stored in non-volatile memory with room for over 300 seconds of data. The *eX*AD-8 is rugged enough so that it can go anywhere at anytime with few concerns. Shipping and field operations with a high accuracy instrument are no longer a worry. Geophone cables can be replaced in seconds.

***eX*AD Vibration/Sound Analysis Tools** - *Science in the Software* - The included *eX*AD Vibration/Sound Analysis Tools software is a powerful suite of analytical tools for vibration and sound measurement, in a fully integrated Windows™ based environment. It offers unmatched analysis of all motion and sound levels, yet is easily used by almost anyone. Analytical capabilities include time history zoom of data, comparison of data with respect to user defined vibration limits, spectral analysis (FFT), and RMS vibration and sound level measurement (A-weighted, fast response). Of course, the *eX*AD software also prints standard reports on your office printer.



*eX*AD-8 Specifications

Microprocessor: 8XC52 Family
Display: 4 Line by 20 Column Liquid Crystal
Keyboard: 1 X 4 Sealed Membrane
Communications: Serial RS232, 57600 Baud
Clock: Integrated Battery Backed Real Time Clock
Battery: 6 V, Rechargeable Lead Acid Cel, 200 Hrs/Charge
Battery Charger: Universal Voltage
Sensors: 3 Geophones (x,y,z Triaxial arrangement)
1 Condenser Microphone
A/D Converter: 13 Bit Self Calibrating
Anti-Aliasing Filters: (Velocity Channels)
Software Selectable Cutoff : 250 to 2500 Hz

Sample Storage Rate: 1024 SPS/Channel to 5000 Hz (Switchable)
Frequency Response: Velocity 2 to 250 Hz
Frequency Response: Mic. A-Weighted Fast Response 8 KHz
Type 2S True RMS Sound Level Measurement, or Linear 2 - 250
Range: Geophone +/- 80mm/s, Mic: 40 to 90db(A), 90 to 140dB (Linear)
Resolution: Vibration 0.02 mm/s, Mic: 1 dB
Repeatability: Vibration: +/-5% Impulsive Input, Sound: 1dB
Base Level Noise: 0.1 mm/s
Data Storage: Over 300 Events, 2MB memory standard
PC Requirements: Windows 9X, Windows 2000, Windows XP

Specifications Subject to Change Due to Continuous Improvement

WESTERN STATES
DRILLING AND BLASTING, INC.

DRILL SPECIFICATIONS

Atlas Copco Surface Drill Rig

ECM 585II

Great flexibility and performance

Hole range 64 mm - 102 mm (2½"- 4")

Atlas Copco

Technical data ECM 585II		
Recommended hole range		
Hole range	64-102 mm	2½"- 4"
Drill steel dimensions	T38, T45	
Rod handling capacity		
Hole depth	25 m	82'
Hydraulic rock drill		
Montabert / HC109		
Impact power, max.	18 kW	24 HP
Rotation speed	0 - 150 rpm	
Torque, max.	1225 Nm	900 lbf/ft
Engine		
Cummins / QSB 6.7		
Rating at 2200 rpm	165 kW	220 HP
Emission control level	Stage 3	Tier III
Fuel tank		
Capacity	400 l	~106 US gal.
Compressor		
Working pressure, max.	10 bar	140 psi
FAD	128 l/s	270 cfm
Boom variant		
Type	Extendible	
Feed		
Feeding system	Chain	
Feed lenght, total	8 341 mm	27'
Travel lenght	4 250 mm	14'
Feed extension	1 500 mm	4'11"
Feed rate, max.	0.6 m/s	115 ft/min
Feed force, max.	19.6 kN	4400 lbf
Pull force, max	19.6 kN	4400 lbf
Tramming		
Tramming speed max.	3.2 km/h	2 mph
Traction force	89.6 kN	20 000 lbf
Hill climbing ability	30° (In CE 20°)	
Track oscillation	±9°	
Ground clearance	420 mm	16,5"
Transport dimensions, approximately		
Weight (exkl. optional equipment)	14 tonnes	30.860 lb
Width	2.47 m	8'2"
Lenght	9.70 m	31'10"
Height	3.10 m	10'2"

Standard equipment

- Limited ambient temperature: 52 deg. C
- Rod handling system prepared for 6 x 3 660 m T45 rods with 63 mm couplings
- Track chains with triple grouser pads
- Full length track guard
- Two speed traction motor
- Work lights
- Back up alarm
- Warning horn
- Engine auto throttle
- Cab
- Cab air conditioning system
- Safety switch on operators seat
- Back mirror
- Inclinometer instrument in Cab
- Safety shutdown device on feed
- Rod handling system
- Rod handling system one lever control
- Rod handling lockout system
- Vertical sliding dust hood
- Dust collector
- Two lever drilling control
- Percussion hour meter
- Smooth drilling system
- Thread greasing device, brush system
- JIC hydraulic hose couplings
- Low level indicator for fuel and hydraulic oil
- Standard tool kit
- First 50 hrs service kit for compressor

Selection of optional equipment

- Rod handling system prepared for 6 x 3 660 m T38 rods with 55 mm couplings
- Rod handling system prepared for 6 x 3 660 m T45 rods with 66 mm couplings
- Track chains with single grouser pads (only available for CE)
- Cold weather kit
- Anti freezing system
- Angle indicator 2-D Lim
- Angle indicator 3-D Lim
- Water mist system (tank included)
- Water mist system (exclusive tank)
- Dust pre-separator
- Gas charging equipment (for rock drill)
- Conversion kit T45 63 mm sleeves to 66 mm sleeves
- Conversion kit to T38 55 mm sleeves
- Hydraulic pressure test kit

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Atlas Copco

www.atlascopco.com

Atlas Copco Surface drill rig

ECM 720

Tough enough to lead, rugged enough to last

Hole range 102 mm-140 mm (4"-5 $^{1}/_{2}$")

Atlas Copco

Technical data ECM 720		
Recommended hole range		
Hole range	102-140 mm	4"- 5½"
Drill steel dimensions	T51, T60	
Rod handling capacity		
Hole depth	29.5 m	97'
Hydraulic rock drill		
HC200A		
Impact power, max.	26 kW	35 HP
Rotation speed	0 - 135 rpm	
Torque, max.	1280 Nm	950 ft.lbf
Engine		
CAT C11		
Rating at 1800 rpm	287 kW	385 HP
Emission control level	Stage 3	Tier III
Fuel tank		
Capacity	587 l	~155 US gal.
Compressor		
Working pressure, max.	10.3 bar	150 psi
FAD	226 l/s	480 cfm
Boom variant		
Type	Telescopic	
Feed		
Feeding system	Chain	
Feed lenght, total	8 788 mm	28'10"
Travel length	5 182 mm	17'
Feed extension	1 524 mm	5'
Feed rate, max.	0.96 m/s	190 ft/min
Feed force, max.	33.8 kN	7600 lbf
Pull force, max	33.8 kN	7600 lbf
Tramming		
Tramming speed max.	3.2 km/h	2 mph
Traction force	125.4 kN	28 192 lbf
Hill climbing ability	30°	
Track oscillation	±10°	
Ground clearance	432 mm	17"
Transport dimensions, approximately		
Weight (excl. optional equipment)	20.5 tonnes	45.300 lb
Width	2.57 m	8'5"
Reaching shortest length		
Length	10.72 m	35'2"
Height	3.94 m	12'11"
Reaching lowest height		
Length	12.17 m	39'11"
Height	3.33 m	10'11"

Standard equipment

- Mechanized rod handling
- Engine automatic throttle
- Progressive anti jamming system (Strata Sense)
- Load sense hydraulic system
- Central hydraulic system test ports
- Variable speed cooling fan control
- Tier III emmission compliance
- 2D electronic angle indicator
- Boom extension
- Feed extension
- Dual pinning for L/R horizontal drilling
- Water mist system preplumbed for tank
- Preseparator
- Dust collector
- Retractable dust hood
- Hydraulic Centralizer
- Thread greasing device
- FOPS and ROPS operator safety cab
- Cab air-conditioning/heating
- Working lights
- Back up alarm
- Heavy duty tracks with full length rock guards
- Track Oscillation
- Rock drill Automatic Lubricator device

Selection of optional equipment

- 3D angle indicator
- 3D angle indicator with speed and depth
- Central lubrication system
- 14' rod changer group
- Hydraulic pressure test kit
- Conversion kit T51/T60
- Pressurized water mist tank 80 gal
- Gas charging kit
- Diesel fired engine preheater 45.000 btu
- Arctic Package
  - Diesel fired engine preheater 100.000 btu
  - Arctic Hosing
  - Arctic fluids
  - Hydraulic and fuel tank heaters
  - Compressor air regulator heater
  - Water tank heater (if ordered with water tank)
  - Compressor air tank relief valve

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Atlas Copco

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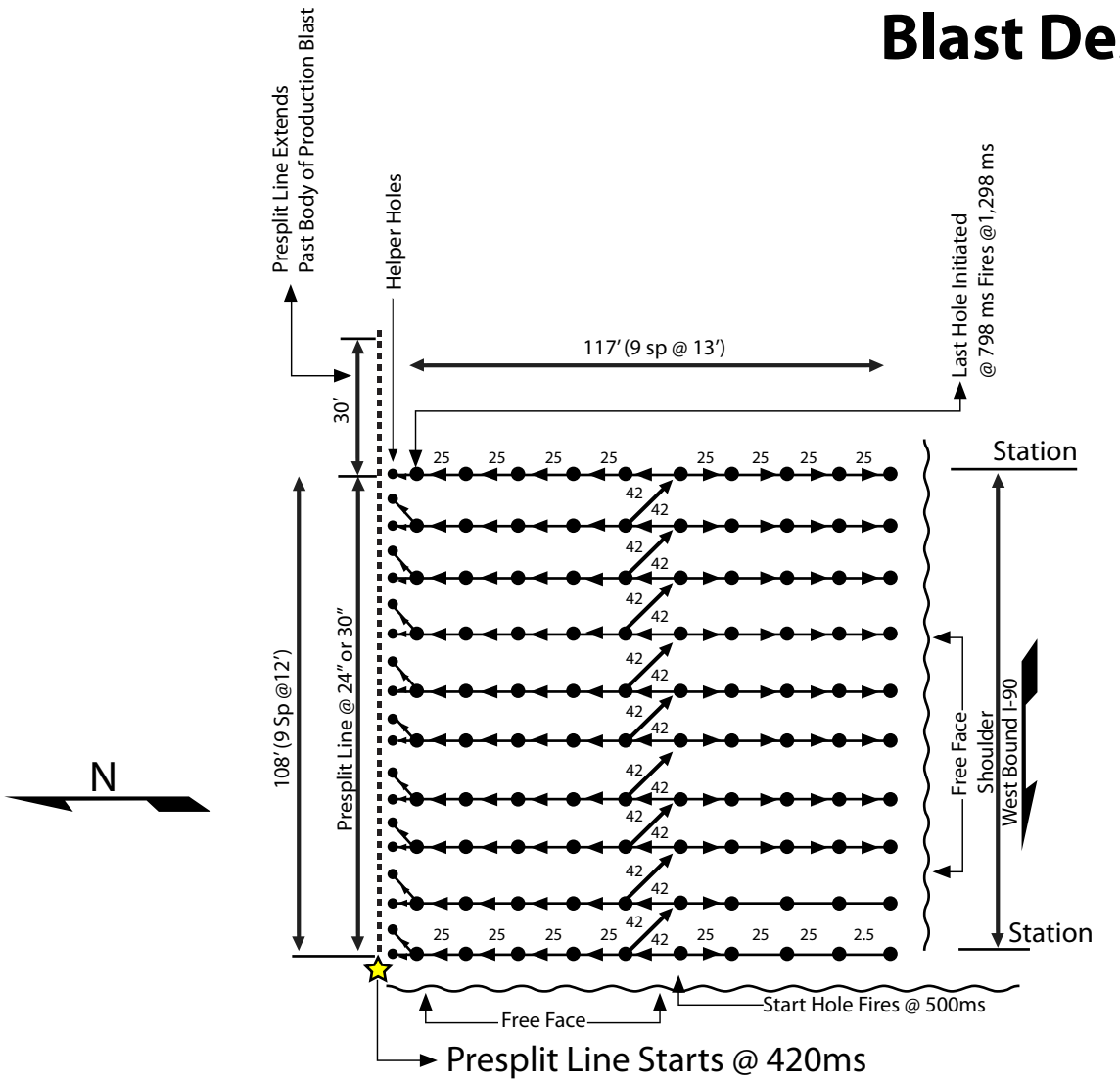
WESTERN STATES
DRILLING AND BLASTING, INC.

BLASTING DIAGRAMS

Blast Design 1



Presplit Line Starts @ 420ms
Max 70 Holes with 10 Holes
Per Delay @ 9ms

Last Hole Fires @ 463ms
i.e. 27ms Before First Production
Hole and 335ms Before Last Hole is
ignited.

Plan View/Timing
(theoretical)

Proposed Blast Design
for

First blast @ each Station adjacent to I-90

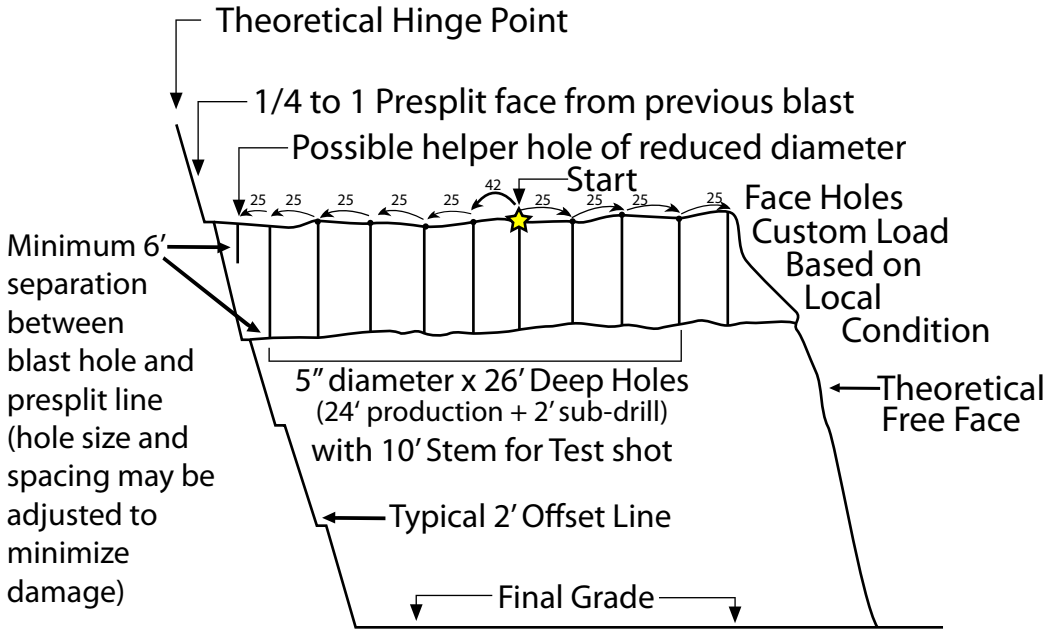
Presplit Powder: 1" Diameter detagel (or equivalent)

Production Explosives: Emulsion/ANFO 80/20 blend

Detonators: 40' Handidet (or equivalent) 25/500ms

Stemming: Screened angular aggregate less than 1/8"

Design Powder Factor: 1.14lbs. per cubic yards



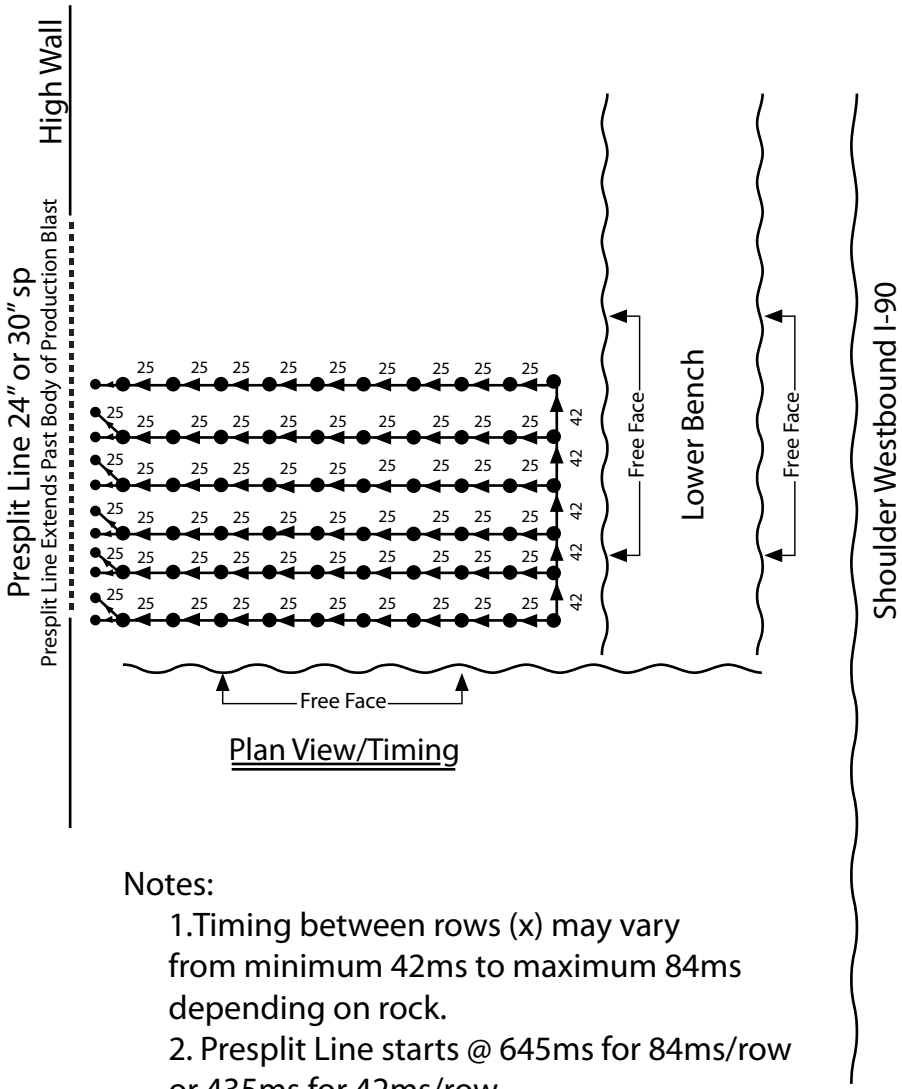
Cross Section
(theoretical)

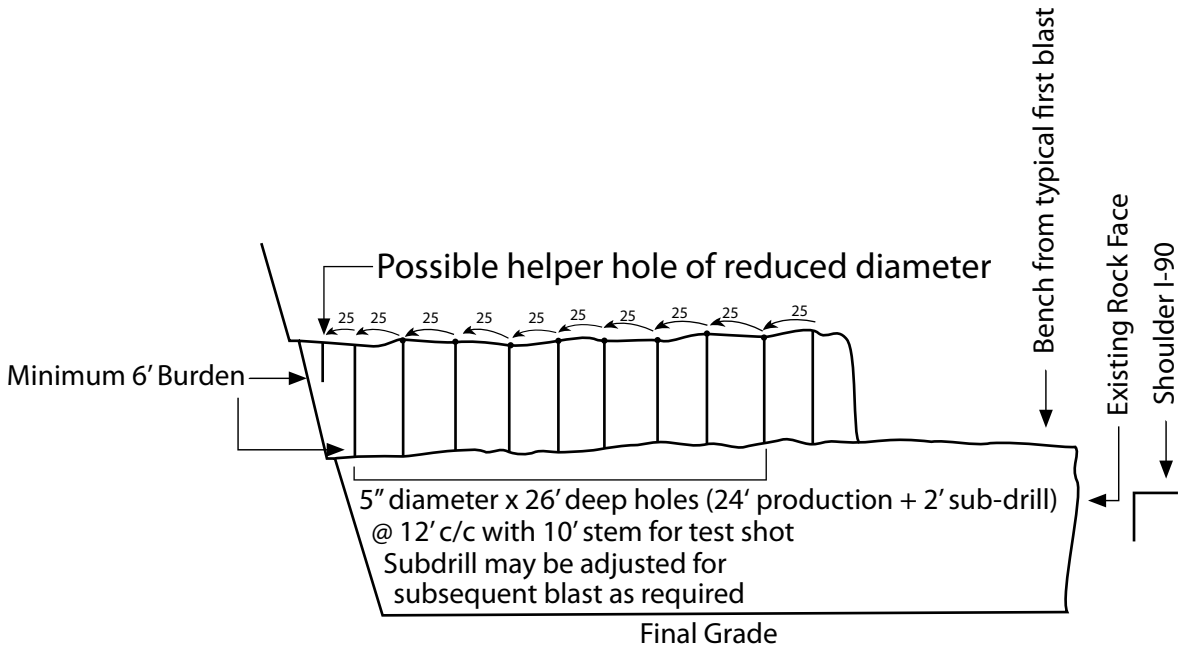
Notes:

1. This blast design will be used for the initial test shot and may be modified for subsequent blasts.
2. Primary rock movement will be parallel to I-90 with minimal verical and lateral projection.
3. Powder factor 1.14#/yd.

REVISION I 05.07.2010

Blast Design 2





Notes:

1.Timing between rows (x) may vary from minimum 42ms to maximum 84ms depending on rock.

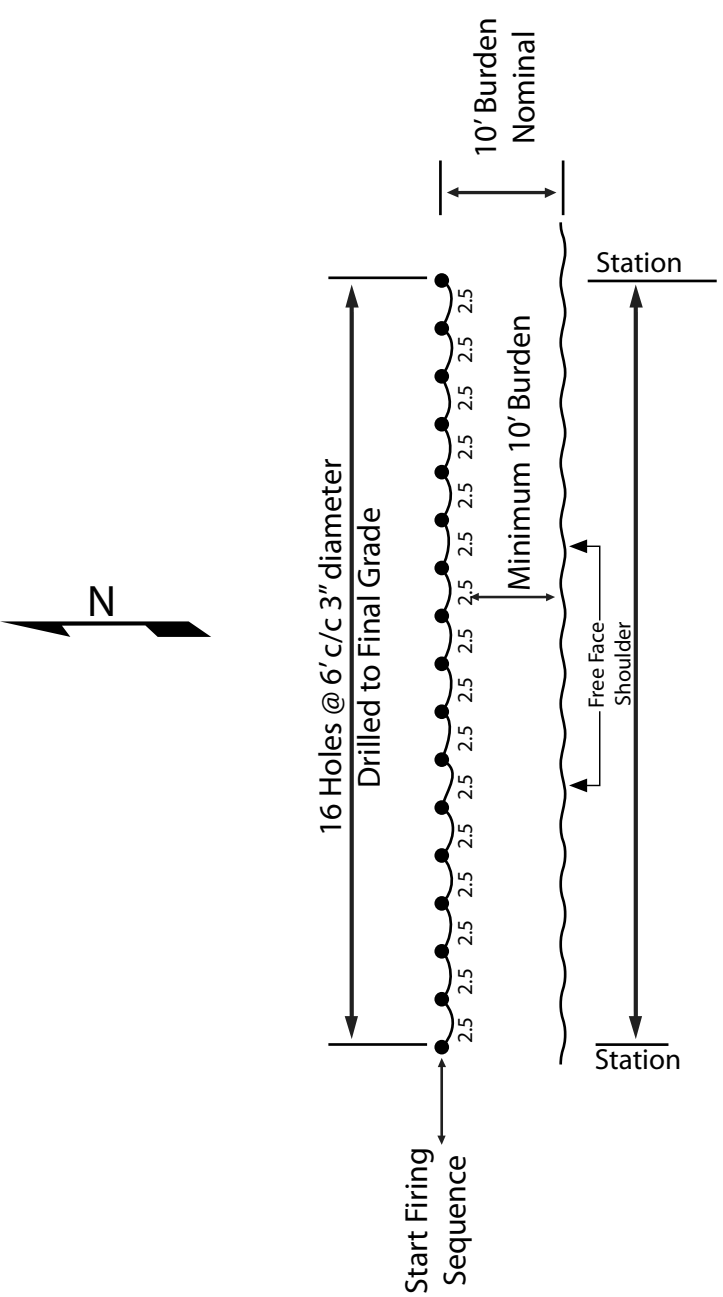
2. Presplit Line starts @ 645ms for 84ms/row or 435ms for 42ms/row.

3. This blast design may be used for areas where distance from I-90 westbound allow some lateral projection.

REVISION I 05.07.2010

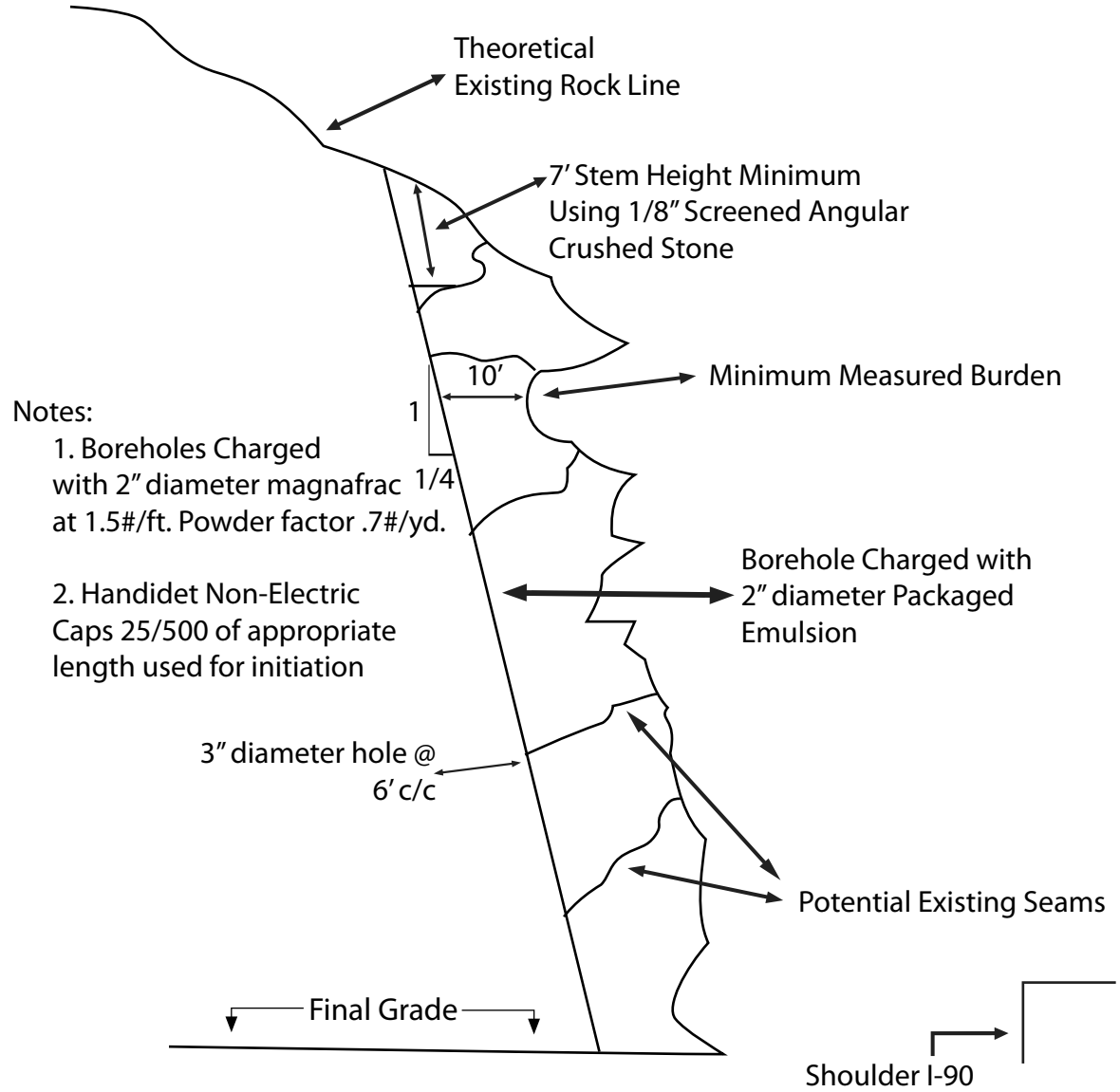
Blast Design 3

Will only be used with full authorization from project engineer
Separate detailed plans for each application will be submitted for each blast.



PLAN VIEW/TIMING

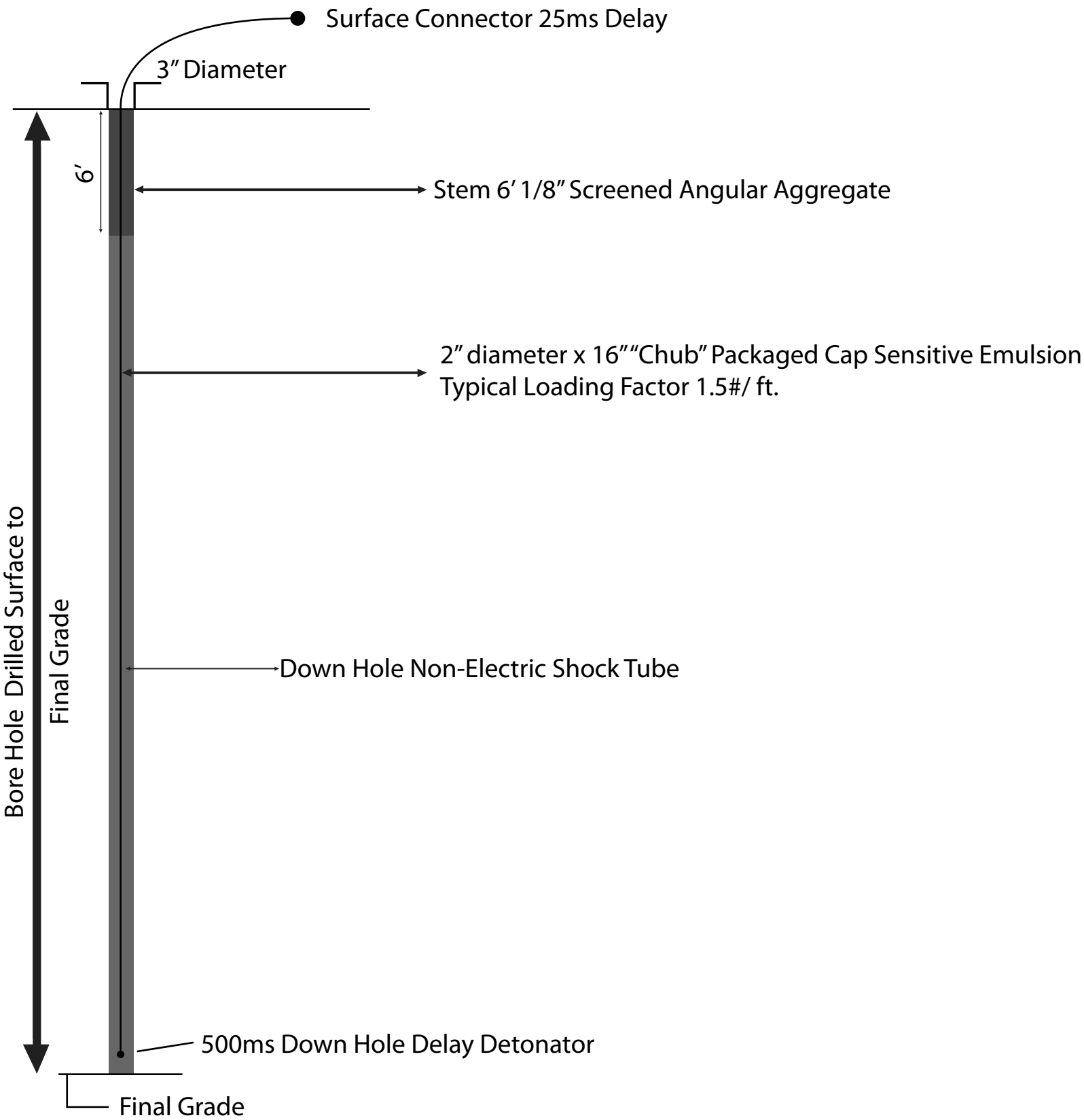
Proposed Design for
Trim Blasting Along Irregular Faces



PROFILE

REVISION I 05.07.2010

Typical 3” Diameter Trim Blast Bore Hole



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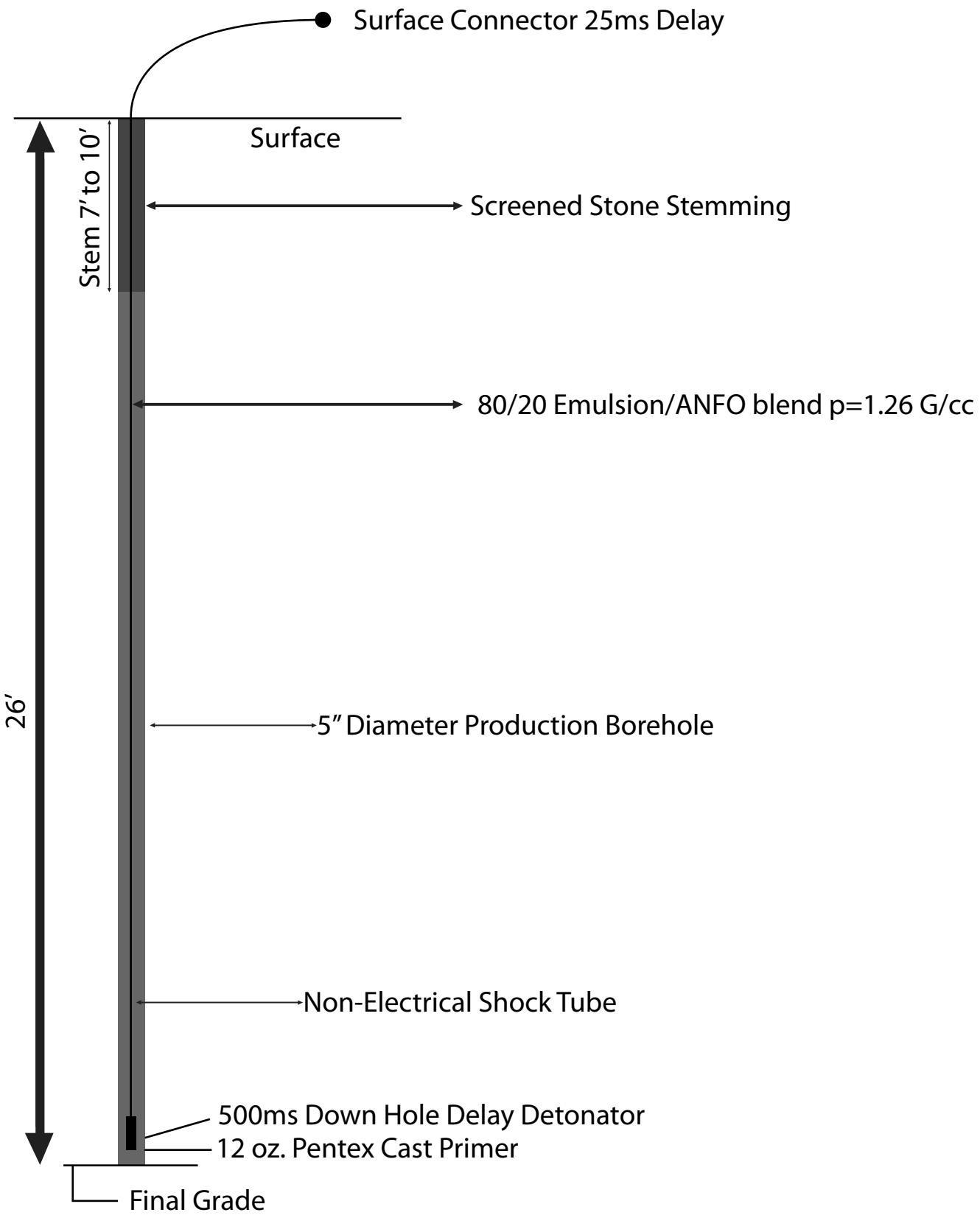
Typical 5” Diameter Production Blast Bore Hole

Hole depth may be increased to provide additional sub-drill
if needed following evaluation of test blast results



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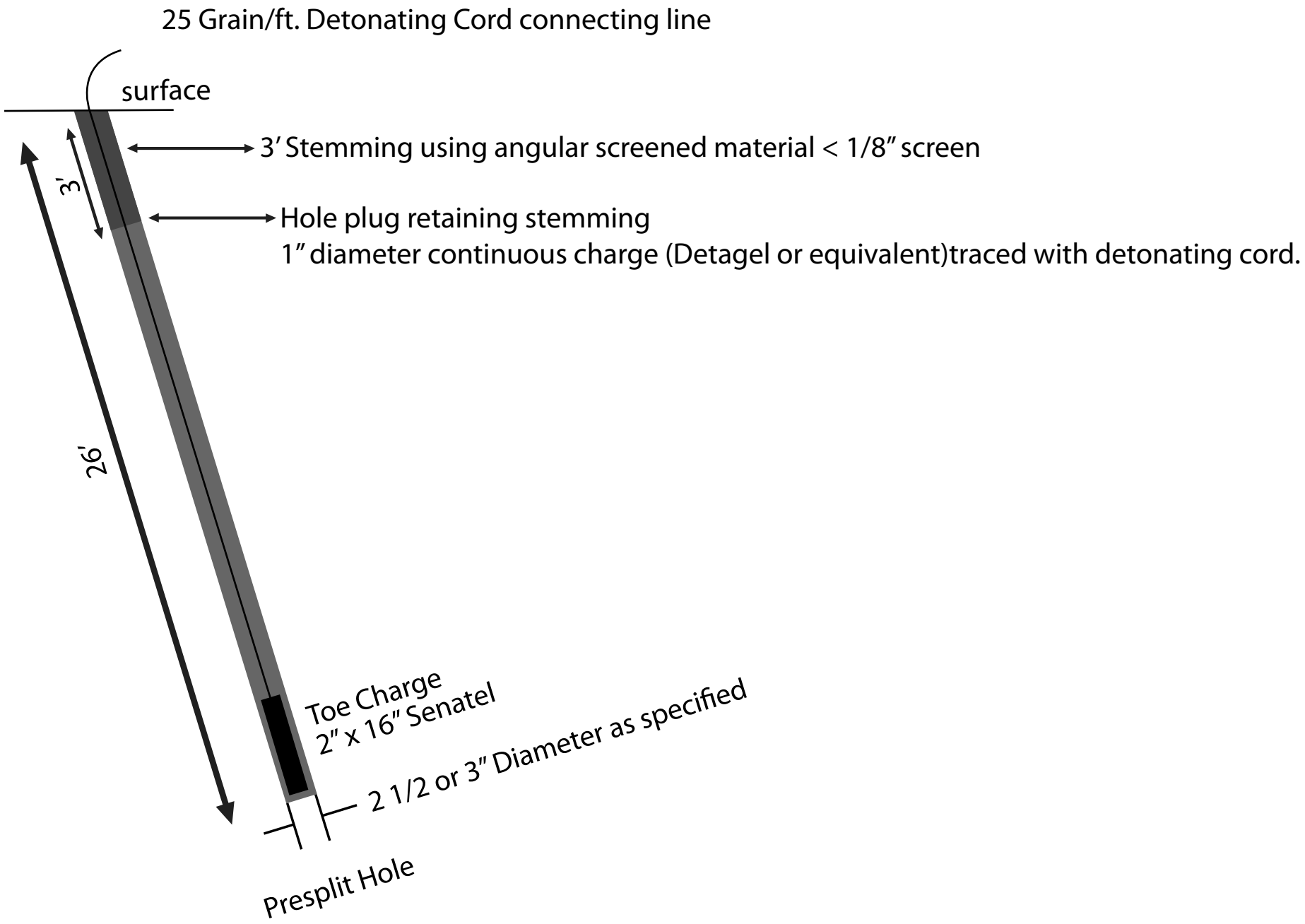
Typical Presplit Loading Diagram



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WESTERN STATES
DRILLING AND BLASTING, INC.

MATERIAL SAFETY DATA SHEETS (MSDS)
TECHNICAL DATA CSHEETS (TDS)

Material Safety Data Sheet

Preparation Date: 24-Aug-2007 **Revision Date:** 18-Jul-2008 **Revision Number:** 1

SECTION 1 – PRODUCT AND COMPANY IDENTIFICATION

Supplier(s):

Orica Canada Inc.
Maple Street
Brownsburg, QC
For MSDS Requests: 1-450-533-4201

Orica USA Inc.
33101 E. Quincy Avenue
Watkins, CO 80137-9406
For MSDS Requests: 1-303-268-5000

Product Name: **Senatel™ Magnafrac™ & Senatel™ Magnafrac™ HW**
Product Code: 107
Alternate Name(s): Magnafrac™ & Magnafrac™ HW
UN-No: UN0241
Recommended Use: A detonator sensitive emulsion explosive.

Emergency Telephone Number: FOR CHEMICAL EMERGENCIES (24 HOUR) INVOLVING TRANSPORTATION, SPILL, LEAK, RELEASE, FIRE OR ACCIDENTS: **IN CANADA CALL:** THE ORICA TRANSPORTATION EMERGENCY RESPONSE SYSTEM AT **1-877-561-3636. IN THE U.S. CALL: CHEMTREC 1-800-424-9300. IN THE U.S.:** FOR LOST, STOLEN, OR MISPLACED EXPLOSIVES CALL: BATF **1-800-800-3855.** FORM ATF F 5400.0 MUST BE COMPLETED AND LOCAL AUTHORITIES (STATE/MUNICIPAL POLICE, ETC.) MUST BE ADVISED.

SECTION 2 – HAZARD IDENTIFICATION

Emergency Overview:
Risk of explosion by shock, fire of other sources of ignition. May cause skin irritation and/or dermatitis. Irritating to eyes. Harmful if swallowed. Oxidizing agent. May cause methemoglobinemia. May cause liver damage. May cause kidney damage.

Appearance:	**Physical State:**	**Odor:**
Orange, viscous, putty-like	Viscous, putty-like	Odorless

SECTION 3 – COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Name	**CAS-No**	**Weight %**
Ammonium Nitrate	6484-52-2	70-80
Sodium Nitrate	7631-99-4	2-12
Mineral Oil	64742-53-6	1-6

SECTION 4 – FIRST AID MEASURES

General Advice: In case of accident or if you feel unwell, seek medical advice IMMEDIATELY (show the product label where possible).

Eye Contact: Immediately flush with plenty of water. After initial flushing, remove any contact lenses and continue flushing for at least 15 minutes. Immediate medical attention is required.

Skin Contact: Wash off immediately with soap and plenty of water, removing all contaminated clothes and shoes. If skin irritation persists, call a physician.

Inhalation: Move victim to fresh air. Give artificial respiration ONLY if breathing has stopped. Give cardiopulmonary resuscitation (CPR) if there is no breathing AND no pulse. Obtain medical advice IMMEDIATELY.

Ingestion: Immediate medical attention is required. Do no induce vomiting. Clean mouth with water and afterwards drink plenty of water. If spontaneous vomiting occurs, have victim lean forward with head positioned to avoid breathing in of vomitus, rinse mouth and administer more water. Never give anything by mouth to and unconscious person.

Notes to physician: Symptomatic. Administer oxygen if there are signs of cyanosis. If clinical condition deteriorates, administer 10cc Methylene Blue intravenously. It is unlikely for this to be required with methemoglobin level of less than 40%.

SECTION 5 – FIRE-FIGHTING MEASURES

Flammable properties: Not itself combustible but assists fire in burning materials. The product does not flash. Rate of burning: does not sustain burning at atmospheric pressure.

Suitable extinguishing media: DO NOT FIGHT FIRES INVOLVING EXPLOSIVES. Evacuate surrounding areas. When controlling fire before involvement of explosives, fire-fighters should wear positive pressure self-containing breathing apparatus (SCBA) and full turnout gear. Water may be applied through fixed extinguishing system (sprinklers) as long as people need not be present for the system to operate.

Unsuitable extinguishing media: DO NOT FIGHT FIRES INVOLVING EXPLOSIVES. Attempts to smother a fire involving this product will be ineffective as it is its own oxygen source. Smother this product could lead to decomposition and explosion. This product is more sensitive to detonation if contaminated with organic or oxidisable material or if heated while confined. Unless the mass of product on fire is flooded with water, re-ignition is possible.

Specific hazards arising from the chemical: This product is a high explosive with mass detonation hazard. DO NOT FIGHT FIRES INVOLVING EXPLOSIVE MATERIALS. Immediately evacuate all personnel from the area to a safe distance. Guard against re-entry. Thermal decomposition can lead to release of irritating gases and vapors.

Protective equipment and precautions for firefighters: As in any fire, wear self-contained breathing apparatus pressure-demand, NIOSH approved (or equivalent) and full protective gear.

SECTION 6 – ACCIDENTAL RELEASE MEASURES

Methods for containment: Contain or absorb leaking putty with sand or earth or other suitable substance.

Methods for cleaning up: Avoid the use of metal tools containing iron and/or copper. Be careful to avoid shock, friction, and contact with grit. Collect product for recovery or disposal. For release to land, contain discharge by constructing dykes or applying inert absorbent; for release to water, utilize damming and/or water diversion to minimize the spread of contamination. Collect contaminated soil and water, and absorbent for proper disposal. Notify applicable government authority if release is reportable or could adversely affect the environment.

Other information: Deactivating chemicals: Detergents will break up emulsions if mixed in.

SECTION 7 – HANDLING AND STORAGE

Handling: This product is an explosive and should only be used under the supervision of trained personnel. The use of coveralls is recommended. Use good industrial hygiene and housekeeping practices. Keep away from open flames, hot surfaces and sources of ignition.

Storage: Store under moderate temperatures recommended by a technical services representative. Store under dry conditions in a well ventilated magazine that has been approved for either detonator storage or explosive storage. Do NOT store explosives in a detonator magazine or detonators in an explosive magazine. Keep away from heat, spark and flames. Keep containers closed. Explosives should be kept well away from initiating explosives; protected from physical damage; separated from oxidizing materials; combustibles, and sources of heat. Keep away from incompatibles. Ideal storage temperature is 10-27°C (50-80°F). Do not expose sealed containers to temperatures above 40°C (104°F).

SECTION 8 – EXPOSURE CONTROLS/PERSONAL PROTECTION

Chemical Name	ACGIH TLV	OSHA PEL	NIOSH IDLH
Sodium Nitrate	10 mg/cu m (nuisance dust)	NA	
Mineral Oil	5 mg/m³	5 mg/ m³	

Other exposure guidelines: Ammonium Nitrate: ORICA Guideline 5 mg/m^3 (internal TWA)

Engineering Measures: No information available.

Personal Protective Equipment

Eye/Face Protection: Tightly fitting safety goggles.

Skin Protection: User should verify impermeability under normal conditions of use prior to general use. Impervious butyl rubber gloves.

Respiratory Protection: In case of insufficient ventilation wear suitable respiratory equipment. A NIOSH-approved respirator, if required.

Hygiene Measures: Handle in accordance with good industrial hygiene and safety practice. Recommendations listed in this section indicate the type of equipment, which will provide protection against over exposure to this product. Conditions of use, adequacy of engineering or other control measures, and actual exposures will dictate the need for specific protective devices at your workplace.

SECTION 9 – PHYSICAL AND CHEMICAL PROPERTIES

Appearance:	Orange, viscous putty-like	**Odor:**	Odorless
Physical State:	Putty-like	**Viscosity:**	No information available
pH:	4-6	**Flash Point:**	Not applicable
Autoignition Temperature:	230-265℃/ 446-509℉	**Boiling Point/Range:**	None
Melting Point/Range:	Not available	**Flammable Limits (Upper):**	Not applicable
Flammable Limits (Lower):	Not applicable	**Explosion Power:**	No data available
Specific Gravity:	1.09-1.33 g/cc	**Water Solubility:**	Negligible
Other Solubility:	No information available	**Vapor Pressure:**	0 mmHg @ 20℃
Oxidizing Properties:	Oxidizer	**Partition Coefficient (n-octanol/water):**	No data available

SECTION 10 – STABILITY AND REACTIVITY

Stability: Stable under normal conditions. Decomposition Temperature: Ammonium Nitrate will spontaneously decompose at 210℃ (410℉).

Conditions to avoid: Keep away from open flames, hot surfaces and sources of ignition. Not expected to be sensitive to static discharge. Not expected to be sensitive to mechanical impact.

Incompatible materials: Avoid oxidizable materials, metal powder, bronze & copper alloys, fuels (e.g. lubricants, machine oils), fluorocarbon lubricants, acids, corrosive liquids, chlorate, sulphur, sodium nitrite, charcoal, coke and other finely divided combustibles. Strong oxidizing and reducing agents.

Hazardous decomposition products: The following toxic decomposition products may be released. At temperatures above 210℃, decomposition may be explosive, especially if confined. Nitrogen oxides (NOx). Carbon oxide. Hydrocarbons.

Hazardous Polymerization: None under normal processing. Hazardous polymerization does not occur. Explosive material under shock conditions.

SECTION 11 – TOXICOLOGICAL INFORMATION

Acute Toxicity

Product Information: Irritating to eyes. May cause skin irritation. Harmful if swallowed.

Chemical name	LD50 Oral	LD50 Dermal	LC50 Inhalation
Ammonium Nitrate	2217 mg/kg Rat	3000 mg/kg Rabbit	88.8 mg/L Rat 4 h
Sodium Nitrate	1267-4300 mg/kg Rat		
Mineral Oil	4300 mg/kg Rat		

Subchronic Toxicity (28 Days): Sodium Nitrate; Ammonium Nitrate: Ingestion may cause methemoglobinemia. Initial manifestation of methemoglobinemia is cyanosis, characterized by navy lips, tongue and mucous membranes, with skin color being slate grey. Further manifestation is characterized by headache, weakness, dyspnea, dizziness, stupor, respiratory distress and death due to anoxia. If ingested, nitrates may be reduced to nitrites by bacteria in the digestive tract. Signs and symptoms of nitrite poisoning include methemoglobinemia, nausea, dizziness, increased heart rate, hypotension, fainting and, possibly shock.

Chronic Toxicity: May cause methemoglobinemia.

Carcinogenicity: The ingredients of this product are not classified as carcinogenic by ACGIH (American Conference of Governmental Industrial Hygienists) or IARC (International Agency for Research on Cancer), not regulated as carcinogens by OSHA (Occupational Safety and Health Administration), and not listed as carcinogens by T\NTP (National Toxicology Program).

Mutagenic effects: There is no evidence of mutagenic potential.

Irritation: Irritating to eyes. May cause irritation of respiratory tract. May cause skin irritation in susceptible persons.

Reproductive effects: No information is available and no adverse reproductive effects are anticipated.

Developmental effects: No information is available and no adverse developmental effects are anticipated.

Target Organ: Eyes, skin, respiratory system, blood, liver urinary tract, & gastrointestinal tract (GI).

SECTION 12 – ECOLOGICAL INFORMATION

Ecotoxicity effects: Dissolves slowly in water. Harmful to aquatic life at low concentrations.
Environmental Effects: Can be dangerous if allowed to enter drinking water intakes. Do not contaminate domestic or irrigation water supplies, lakes, streams, ponds, or rivers.

Chemical Name	Freshwater Algae Data	Freshwater Fish Species Data	Microtox Data	Water Flea Data	log Pow
Sodium Nitrate					-3.8

Persistence/Degradability: Some water resistance but soluble with extended time periods.
Mobility in Environmental media: Dissolves slowly in water

SECTION 13 – DISPOSAL CONSIDERATIONS

Waste Disposal Method: Burn under supervision of an expert at an explosive burning ground or destroy by detonation in boreholes, in accordance with applicable local, provincial and federal regulations. Call upon the services of an Orica Technical Representative.

SECTION 14 – TRANSPORT INFORMATION

DOT Proper Shipping Name: Explosive, blasting type E
Hazard Class: 1.1D
UN-No: UN0241
Packing group: II
TDG Proper Shipping Name: Explosive, blasting type E
Hazard Class: 1.1D
UN-No: UN0241
Packing group: II

Transportation Emergency Telephone Number: 1-877-561-3636 or CHEMTREC: 1-800-424-9300

SECTION 15 – REGULATORY INFORMATION

CANADIAN CLASSIFICATION: This product has been classified in accordance with the hazard criteria of the CPR (Controlled Products Regulations) and this MSDS contains all the information required by the CPR

WHMIS hazard class: This product is an explosive and is not regulated by WHMIS.
USA CLASSIFICATION:
SARA Regulations Sections 313 and 40 CFR 372: This product contains the following toxic chemical(s) subject to reporting requirements, Ammonium Nitrate (6484-52-2), Sodium Nitrate (7631-99-4) & Mineral Oil (64742-53-6).
SARA 311/312 Hazardous Categorization
Acute Heath Hazard: Yes
Chronic Health Hazard: Yes
Fire Hazard: No
Reactive Hazard: Yes
Sudden Release of Pressure Hazard: Yes
Ozone Protection and 40 CFR 42: No reportable quantities of ozone depleting agents
Other Regulations/Legislations which apply to this product: New Jersey Right-to-Know, Pennsylvania Right-to-Know, Massachusetts Right-to-Know, Rhode Island Right-to-Know, Florida, New Jersey Special Health Hazard Substance List, Minnesota Hazardous Substance List, California Director's List of Hazardous Substances, California Proposition 65.

TSCA: Complies **DSL:** Complies **NDSL:** Complies

The components in the product are on the following international inventory lists:

Chemical Name	TSCA	DSL	NDSL	ENCS	EINECS	ELINCS	CHINA	KECL	PICCS	AICS
Ammonium Nitrate	X	X	-	X	X	-	X	X	X	X
Sodium Nitrate	X	X	-	X	X	X	X	X	X	X
Mineral Oil	X	X	-	-	X	-	X	X	X	X

Legend: X – Listed

SECTION 16 – OTHER INFORMATION

Prepared by: **Safety Health & Environment**
303-268-5000

Preparation Date: 24-Aug-2007
Revision Date: 18-Jul-2008

The information contained herein is offered only as guide to the handling of this specific material and has been prepared in good faith by technically knowledgeable personnel. It is not intended to be all-inclusive and the manner and conditions of use and handling may involve other and additional considerations. No warranty of any kind is given or implied and Orica will not be liable for any damages, losses, injuries or consequential damages which may result from the use of or reliance on any information contained herein.

End of MSDS

Material Safety Data Sheet

Preparation Date: 24-Aug-2007 **Revision Date:** 18-Jul-2008 **Revision Number:** 1

SECTION 1 – PRODUCT AND COMPANY IDENTIFICATION

Supplier(s):

Orica Canada Inc.
Maple Street
Brownsburg, QC
For MSDS Requests: 1-450-533-4201

Orica USA Inc.
33101 E. Quincy Avenue
Watkins, CO 80137-9406
For MSDS Requests: 1-303-268-5000

Product Name:	**Senatel™ Magnasplit™**
Product Code:	108
Alternate Name(s):	Magnasplit™
UN-No:	UN0241
Recommended Use:	A detonator sensitive emulsion explosive.

Emergency Telephone Number: FOR CHEMICAL EMERGENCIES (24 HOUR) INVOLVING TRANSPORTATION, SPILL, LEAK, RELEASE, FIRE OR ACCIDENTS: **IN CANADA CALL:** THE ORICA TRANSPORTATION EMERGENCY RESPONSE SYSTEM AT **1-877-561-3636. IN THE U.S. CALL: CHEMTREC 1-800-424-9300. IN THE U.S.:** FOR LOST, STOLEN, OR MISPLACED EXPLOSIVES CALL: BATF **1-800-800-3855.** FORM ATF F 5400.0 MUST BE COMPLETED AND LOCAL AUTHORITIES (STATE/MUNICIPAL POLICE, ETC.) MUST BE ADVISED.

SECTION 2 – HAZARD IDENTIFICATION

Emergency Overview:
Risk of explosion by shock, fire of other sources of ignition. May cause skin irritation and/or dermatitis. Irritating to eyes. Harmful if swallowed. Oxidizing agent. May cause methemoglobinemia. May cause liver damage. May cause kidney damage.

Appearance:	**Physical State:**	**Odor:**
Orange viscous putty-like	Viscous, putty-like	Odorless

SECTION 3 – COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Name	**CAS-No**	**Weight %**
Ammonium Nitrate	6484-52-2	40-80
Sodium Nitrate	7631-99-4	2-12
Mineral Oil	64742-53-6	1-6

SECTION 4 – FIRST AID MEASURES

General Advice:	In case of accident or if you feel unwell, seek medical advice IMMEDIATELY (show the product label where possible).
Eye Contact:	Immediately flush with plenty of water. After initial flushing, remove any contact lenses and continue flushing for at least 15 minutes. Immediate medical attention is required.
Skin Contact:	Wash off immediately with soap and plenty of water, removing all contaminated clothes and shoes. If skin irritation persists, call a physician.
Inhalation:	Move victim to fresh air. Give artificial respiration ONLY if breathing has stopped. Give cardiopulmonary resuscitation (CPR) if there is no breathing AND no pulse. Obtain medical advice IMMEDIATELY.
Ingestion:	Immediate medical attention is required. Do no induce vomiting. Clean mouth with water and afterwards drink plenty of water. If spontaneous vomiting occurs, have victim lean forward with head positioned to avoid breathing in of vomitus, rinse mouth and administer more water. Never give anything by mouth to and unconscious person.
Notes to physician:	Symptomatic. Administer oxygen if there are signs of cyanosis. If clinical condition deteriorates, administer 10cc Methylene Blue intravenously. It is unlikely for this to be required with methemoglobin level of less than 40%.

SECTION 5 – FIRE-FIGHTING MEASURES

Flammable properties: Not itself combustible but assists fire in burning materials. The product does not flash. Rate of burning: does not sustain burning at atmospheric pressure.

Suitable extinguishing media: DO NOT FIGHT FIRES INVOLVING EXPLOSIVES. Evacuate surrounding areas. When controlling fire before involvement of explosives, fire-fighters should wear positive pressure self-containing breathing apparatus (SCBA) and full turnout gear. Water may be applied through fixed extinguishing system (sprinklers) as long as people need not be present for the system to operate.

Unsuitable extinguishing media: DO NOT FIGHT FIRES INVOLVING EXPLOSIVES. Attempts to smother a fire involving this product will be ineffective as it is its own oxygen source. Smother this product could lead to decomposition and explosion. This product is more sensitive to detonation if contaminated with organic or oxidisable material or if heated while confined. Unless the mass of product on fire is flooded with water, re-ignition is possible.

Specific hazards arising from the chemical: This product is a high explosive with mass detonation hazard. DO NOT FIGHT FIRES INVOLVING EXPLOSIVE MATERIALS. Immediately evacuate all personnel from the area to a safe distance. Guard against re-entry. Thermal decomposition can lead to release of irritating gases and vapors.

Protective equipment and precautions for firefighters: As in any fire, wear self-contained breathing apparatus pressure-demand, NIOSH approved (or equivalent) and full protective gear.

SECTION 6 – ACCIDENTAL RELEASE MEASURES

Methods for containment: Avoid dust formation. Do not breathe dust.

Methods for cleaning up: Avoid the use of metal tools containing iron and/or copper. Be careful to avoid shock, friction, and contact with grit. Collect product for recovery or disposal. For release to land, contain discharge by constructing dykes or applying inert absorbent; for release to water, utilize damming and/or water diversion to minimize the spread of contamination. Collect contaminated soil and water, and absorbent for proper disposal. Notify applicable government authority if release is reportable or could adversely affect the environment.

Other information: Deactivating chemicals: Detergents will break up emulsions if mixed in.

SECTION 7 – HANDLING AND STORAGE

Handling: This product is an explosive and should only be used under the supervision of trained personnel. The use of coveralls is recommended. Use good industrial hygiene and housekeeping practices. Keep away from open flames, hot surfaces and sources of ignition.

Storage: Store under moderate temperatures recommended by a technical services representative. Store under dry conditions in a well ventilated magazine that has been approved for either detonator storage or explosive storage. Do NOT store explosives in a detonator magazine or detonators in an explosive magazine. Keep away from heat, spark and flames. Keep containers closed. Explosives should be kept well away from initiating explosives; protected from physical damage; separated from oxidizing materials; combustibles, and sources of heat. Keep away from incompatibles. Ideal storage temperature is 10-27°C (50-80°F). Do not expose sealed containers to temperatures above 40°C (104°F).

SECTION 8 – EXPOSURE CONTROLS/PERSONAL PROTECTION

Chemical Name	ACGIH TLV	OSHA PEL	NIOSH IDLH
Sodium Nitrate	10 mg/cu m (nuisance dust)	NA	
Mineral Oil	5 mg/m³	5 mg/ m³	

Other exposure guidelines: Ammonium Nitrate: ORICA Guideline 5 mg/m^3 (internal TWA)

Engineering Measures: No information available.

Personal Protective Equipment

Eye/Face Protection: Tightly fitting safety goggles.

Skin Protection: User should verify impermeability under normal conditions of use prior to general use. Impervious butyl rubber gloves.

Respiratory Protection: In case of insufficient ventilation wear suitable respiratory equipment. A NIOSH-approved respirator, if required.

Hygiene Measures: Handle in accordance with good industrial hygiene and safety practice. Recommendations listed in this section indicate the type of equipment, which will provide protection against over exposure to this product. Conditions of use, adequacy of engineering or other control measures, and actual exposures will dictate the need for specific protective devices at your workplace.

SECTION 9 – PHYSICAL AND CHEMICAL PROPERTIES

Appearance:	Orange, viscous putty-like	**Odor:**	Odorless
Physical State:	Putty-like	**Viscosity:**	No information available
pH:	4-6	**Flash Point:**	Does not flash
Autoignition Temperature:	230-265°C/ 446-509°F	**Boiling Point/Range:**	None
Melting Point/Range:	Not available	**Flammable Limits (Upper):**	Not applicable
Flammable Limits (Lower):	Not applicable	**Explosion Power:**	No data available
Specific Gravity:	1.15 -1.19 g/cc	**Water Solubility:**	Negligible
Other Solubility:	No information available	**Vapor Pressure:**	0 mmHg @ 20°C
Oxidizing Properties:	Oxidizer	**Partition Coefficient (n-octanol/water):**	No data available

SECTION 10 – STABILITY AND REACTIVITY

Stability: Stable under normal conditions. Decomposition Temperature: Ammonium Nitrate will spontaneously decompose at 210°C (410°F).

Conditions to avoid: Keep away from open flames, hot surfaces and sources of ignition. Not expected to be sensitive to static discharge. Not expected to be sensitive to mechanical impact.

Incompatible materials: Avoid oxidizable materials, metal powder, bronze & copper alloys, fuels (e.g. lubricants, machine oils), fluorocarbon lubricants, acids, corrosive liquids, chlorate, sulphur, sodium nitrite, charcoal, coke and other finely divided combustibles. Strong oxidizing and reducing agents.

Hazardous decomposition products: The following toxic decomposition products may be released. At temperatures above 210°C, decomposition may be explosive, especially if confined. Nitrogen oxides (NOx). Carbon oxide. Hydrocarbons.

Hazardous Polymerization: None under normal processing. Hazardous polymerization does not occur. Explosive material under shock conditions.

SECTION 11 – TOXICOLOGICAL INFORMATION

Acute Toxicity

Product Information: Irritating to eyes. May cause skin irritation. Harmful if swallowed.

Chemical name	LD50 Oral	LD50 Dermal	LC50 Inhalation
Ammonium Nitrate	2217 mg/kg Rat	3000 mg/kg Rabbit	88.8 mg/L Rat 4 h
Sodium Nitrate	1267-4300 mg/kg Rat		
Mineral Oil	4300 mg/kg Rat		

Subchronic Toxicity (28 Days): Sodium Nitrate; Ammonium Nitrate: Ingestion may cause methemoglobinemia. Initial manifestation of methemoglobinemia is cyanosis, characterized by navy lips, tongue and mucous membranes, with skin color being slate grey. Further manifestation is characterized by headache, weakness, dyspnea, dizziness, stupor, respiratory distress and death due to anoxia. If ingested, nitrates may be reduced to nitrites by bacteria in the digestive tract. Signs and symptoms of nitrite poisoning include methemoglobinemia, nausea, dizziness, increased heart rate, hypotension, fainting and, possibly shock.

Chronic Toxicity: May cause methemoglobinemia.

Carcinogenicity: The ingredients of this product are not classified as carcinogenic by ACGIH (American Conference of Governmental Industrial Hygienists) or IARC (International Agency for Research on Cancer), not regulated as carcinogens by OSHA (Occupational Safety and Health Administration), and not listed as carcinogens by T\NTP (National Toxicology Program).

Mutagenic effects: There is no evidence of mutagenic potential.

Irritation: Irritating to eyes. May cause irritation of respiratory tract. May cause skin irritation in susceptible persons.

Reproductive effects: No information is available and no adverse reproductive effects are anticipated.

Developmental effects: No information is available and no adverse developmental effects are anticipated.

Target Organ: Eyes, skin, respiratory system, blood, liver urinary tract, & gastrointestinal tract (GI).

SECTION 12 – ECOLOGICAL INFORMATION

Ecotoxicity effects: Dissolves slowly in water. Harmful to aquatic life at low concentrations.
Environmental Effects: Can be dangerous if allowed to enter drinking water intakes. Do not contaminate domestic or irrigation water supplies, lakes, streams, ponds, or rivers.

Chemical Name	Freshwater Algae Data	Freshwater Fish Species Data	Microtox Data	Water Flea Data	log Pow
Sodium Nitrate					-3.8

Persistence/Degradability: Some water resistance but soluble with extended time periods.
Mobility in Environmental media: Dissolves slowly in water.

SECTION 13 – DISPOSAL CONSIDERATIONS

Waste Disposal Method: Burn under supervision of an expert at an explosive burning ground or destroy by detonation in boreholes, in accordance with applicable local, provincial and federal regulations. Call upon the services of an Orica Technical Representative.

SECTION 14 – TRANSPORT INFORMATION

DOT Proper Shipping Name: Explosive, blasting type E
Hazard Class: 1.1D
UN-No: UN0241
Packing group: II
TDG Proper Shipping Name: Explosive, blasting type E
Hazard Class: 1.1D
UN-No: UN0241
Packing group: II

Transportation Emergency Telephone Number: 1-877-561-3636 or CHEMTREC: 1-800-424-9300

SECTION 15 – REGULATORY INFORMATION

CANADIAN CLASSIFICATION: This product has been classified in accordance with the hazard criteria of the CPR (Controlled Products Regulations) and this MSDS contains all the information required by the CPR

WHMIS hazard class: This product is an explosive and is not regulated by WHMIS.
USA CLASSIFICATION:
SARA Regulations Sections 313 and 40 CFR 372: This product contains the following toxic chemical(s) subject to reporting requirements, Ammonium Nitrate (6484-52-2), Sodium Nitrate (7631-99-4) & Mineral Oil (64742-53-6).
SARA 311/312 Hazardous Categorization
Acute Heath Hazard: Yes
Chronic Health Hazard: Yes
Fire Hazard: No
Reactive Hazard: Yes
Sudden Release of Pressure Hazard: Yes
Ozone Protection and 40 CFR 42: No reportable quantities of ozone depleting agents
Other Regulations/Legislations which apply to this product: New Jersey Right-to-Know, Pennsylvania Right-to-Know, Massachusetts Right-to-Know, Rhode Island Right-to-Know, Florida, New Jersey Special Health Hazard Substance List, Minnesota Hazardous Substance List, California Director's List of Hazardous Substances, California Proposition 65.

TSCA: Complies **DSL:** Complies **NDSL:** Complies

The components in the product are on the following international inventory lists:

Chemical Name	TSCA	DSL	NDSL	ENCS	EINECS	ELINCS	CHINA	KECL	PICCS	AICS
Ammonium Nitrate	X	X	-	X	X	-	X	X	X	X
Sodium Nitrate	X	X	-	X	X	X	X	X	X	X

Mineral Oil	X	X	-	-	X	-	X	X	X	X

Legend: X – Listed

SECTION 16 – OTHER INFORMATION

Prepared by: **Safety Health & Environment**
303-268-5000

Preparation Date: 24-Aug-2007
Revision Date: 18-Jul-2008

The information contained herein is offered only as guide to the handling of this specific material and has been prepared in good faith by technically knowledgeable personnel. It is not intended to be all-inclusive and the manner and conditions of use and handling may involve other and additional considerations. No warranty of any kind is given or implied and Orica will not be liable for any damages, losses, injuries or consequential damages which may result from the use of or reliance on any information contained herein.

End of MSDS

Material Safety Data Sheet

Preparation Date: 10-Sep-2005 **Revision Date:** 18-Jul-2008 **Revision Number:** 1

SECTION 1 – PRODUCT AND COMPANY IDENTIFICATION

Supplier(s):

Orica Canada Inc.
Maple Street
Brownsburg, QC
For MSDS Requests: 450-533-4201

Orica USA Inc.
33101 E. Quincy Avenue
Watkins, CO 80137-9406
For MSDS Requests: 1-303-268-5000

Product Name: **Senatel™ Powersplit™**
Product Code: 111
Alternate Name(s): Magnum™ Powersplit™
UN-No: UN0241
Recommended Use: A detonator sensitive emulsion explosive.

Emergency Telephone Number: FOR CHEMICAL EMERGENCIES (24 HOUR) INVOLVING TRANSPORTATION, SPILL, LEAK, RELEASE, FIRE OR ACCIDENTS: **IN CANADA CALL:** THE ORICA TRANSPORTATION EMERGENCY RESPONSE SYSTEM AT **1-877-561-3636. IN THE U.S. CALL: CHEMTREC 1-800-424-9300. IN THE U.S.:** FOR LOST, STOLEN, OR MISPLACED EXPLOSIVES CALL: BATF **1-800-800-3855.** FORM ATF F 5400.0 MUST BE COMPLETED AND LOCAL AUTHORITIES (STATE/MUNICIPAL POLICE, ETC.) MUST BE ADVISED.

SECTION 2 – HAZARD IDENTIFICATION

Emergency Overview:
Risk of explosion by shock, fire of other sources of ignition. May cause skin irritation and/or dermatitis. Irritating to eyes. Harmful if swallowed. Oxidizing agent. May cause methemoglobinemia. May cause liver damage. May cause kidney damage.

Appearance:	**Physical State:**	**Odor:**
String of plastic wrapped material*	Viscous, putty-like	Odorless

*String of plastic wrapped material traced internally with detonating cord. If the outer plastic is perforated, the exposed product appears putty-like.

SECTION 3 – COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Name	**CAS-No**	**Weight %**
Ammonium Nitrate	6484-52-2	60-100
Sodium Nitrate	7631-99-4	1-5
Pentaerythritol Tetranitrate (PETN)	78-11-5	1-5
Mineral Oil	64742-53-6	1-6

SECTION 4 – FIRST AID MEASURES

General Advice: In case of accident or if you feel unwell, seek medical advice IMMEDIATELY (show the product label where possible).

Eye Contact: Immediately flush with plenty of water. After initial flushing, remove any contact lenses and continue flushing for at least 15 minutes. Immediate medical attention is required.

Skin Contact: Wash off immediately with soap and plenty of water, removing all contaminated clothes and shoes. If skin irritation persists, call a physician.

Inhalation: Move victim to fresh air. Give artificial respiration ONLY if breathing has stopped. Give cardiopulmonary resuscitation (CPR) if there is not breathing AND no pulse. Obtain medical advice IMMEDIATELY.

Ingestion: Immediate medical attention is required. Do no induce vomiting. Clean mouth with water and afterwards drink plenty of water. If spontaneous vomiting occurs, have victim lean forward with

head positioned to avoid breathing in of vomitus, rinse mouth and administer more water. Never give anything by mouth to and unconscious person.

Notes to physician: Symptomatic. Administer oxygen if there are signs of cyanosis. If clinical condition deteriorates, administer 10cc Methylene Blue intravenously. It is unlikely for this to be required with methemoglobin level of less than 40%.

SECTION 5 – FIRE-FIGHTING MEASURES

Flammable properties: Not itself combustible but assists fire in burning materials. The product does not flash. Rate of burning: does not sustain burning at atmospheric pressure.

Suitable extinguishing media: DO NOT FIGHT FIRES INVOLVING EXPLOSIVES. Evacuate surrounding areas. When controlling fire before involvement of explosives, fire-fighters should wear positive pressure self-containing breathing apparatus (SCBA) and full turnout gear. Water may be applied through fixed extinguishing system (sprinklers) as long as people need not be present for the system to operate.

Unsuitable extinguishing media: DO NOT FIGHT FIRES INVOLVING EXPLOSIVES. Attempts to smother a fire involving this product will be ineffective as it is its own oxygen source. Smother this product could leat to decomposition and explosion. This product is more sensitive to detonation if contaminated with organic or oxidisable material or if heated while confined. Unless the mass of product on fire is flooded with water, re-ignition is possible.

Specific hazards arising from the chemical: This product is a high explosive with mass detonation hazard. DO NOT FIGHT FIRES INVOLVING EXPLOSIVE MATERIALS. Immediately evacuate all personnel from the area to a safe distance. Guard against re-entry. Thermal decomposition can lead to release of irritating gases and vapors.

Protective equipment and precautions for firefighters: As in any fire, wear self-contained breathing apparatus pressure-demand, NIOSH approved (or equivalent) and full protective gear.

SECTION 6 – ACCIDENTAL RELEASE MEASURES

Methods for containment: Contain or absorb leaking putty with sand or earth or other suitable substance.

Methods for cleaning up: Avoid the use of metal tools containing iron and/or copper. Be careful to avoid shock, friction, and contact with grit. Collect product for recovery or disposal. For release to land, contain discharge by constructing dykes or applying inert absorbent; for release to water, utilize damming and/or water diversion to minimize the spread of contamination. Collect contaminated soil and water, and absorbent for proper disposal. Notify applicable government authority if release is reportable or could adversely affect the environment.

Other information: Deactivating chemicals: Detergents will break up emulsions if mixed in.

SECTION 7 – HANDLING AND STORAGE

Handling: This product is an explosive and should only be used under the supervision of trained personnel. The use of coveralls is recommended. Use good industrial hygiene and housekeeping practices. Keep away from open flames, hot surfaces and sources of ignition.

Storage: Store under moderate temperatures recommended by a technical services representative. Store under dry conditions in a well ventilated magazine that has been approved for either detonator storage or explosive storage. Do NOT store explosives in a detonator magazine or detonators in an explosive magazine. Keep away from heat, spark and flames. Keep containers closed. Explosives should be kept well away from initiating explosives; protected from physical damage; separated from oxidizing materials; combustibles, and sources of heat. Keep away from incompatibles. Ideal storage temperature is 10-27°C (50-80°F). Do not expose sealed containers to temperatures above 40°C (104°F).

SECTION 8 – EXPOSURE CONTROLS/PERSONAL PROTECTION

Chemical Name	ACGIH TLV	OSHA PEL	NIOSH IDLH
Sodium Nitrate	10 mg/cu m (nuisance dust)	NA	
Mineral Oil	5 mg/m³	5 mg/ m³	

Other exposure guidelines: Ammonium Nitrate: ORICA Guideline 5 mg/m^3 (internal TWA)

Engineering Measures: No information available.

Personal Protective Equipment

Eye/Face Protection: Tightly fitting safety goggles.

Skin Protection: User should verify impermeability under normal conditions of use prior to general use. Impervious butyl rubber gloves.

Respiratory Protection: In case of insufficient ventilation wear suitable respiratory equipment. A NIOSH-approved respirator, if required.

Hygiene Measures: Handle in accordance with good industrial hygiene and safety practice. Recommendations listed in this section indicate the type of equipment, which will provide protection against over exposure to this product. Conditions of use, adequacy of engineering or other control measures, and actual exposures will dictate the need for specific protective devices at your workplace.

SECTION 9 – PHYSICAL AND CHEMICAL PROPERTIES

Appearance:	String of plastic wrapped material	**Odor:**	Odorless
Physical State:	Viscous, putty-like	**Viscosity:**	No information available
pH:	4.5 –6.0	**Flash Point:**	Not applicable
Autoignition Temperature:	No data available	**Boiling Point/Range:**	None
Melting Point/Range:	Not available	**Flammable Limits (Upper):**	Not applicable
Flammable Limits (Lower):	Not applicable	**Explosion Power:**	No data available
Specific Gravity:	1.2 – 1.3 g/cc	**Water Solubility:**	Insoluble
Other Solubility:	Slightly soluble in standard organic solvents	**Vapor Pressure:**	0 mmHg @ 20°C
Oxidizing Properties:	Oxidizer	**Partition Coefficient (n-octanol/water):**	No data available

SECTION 10 – STABILITY AND REACTIVITY

Stability: Stable under normal conditions. Decomposition Temperature: Ammonium Nitrate will spontaneously decompose at 210°C (410°F).

Conditions to avoid: Keep away from open flames, hot surfaces and sources of ignition. Not expected to be sensitive to static discharge. Not expected to be sensitive to mechanical impact.

Incompatible materials: Avoid oxidizable materials, metal powder, bronze & copper alloys, fuels (e.g. lubricants, machine oils), fluorocarbon lubricants, acids, corrosive liquids, chlorate, sulphur, sodium nitrite, charcoal, coke and other finely divided combustibles. Strong oxidizing and reducing agents.

Hazardous decomposition products: The following toxic decomposition products may be released. At temperatures above 210°C, decomposition may be explosive, especially if confined. Nitrogen oxides (NOx). Carbon oxide. Hydrocarbons. Phosgene. Hydrogen chloride gas.

Hazardous Polymerization: None under normal processing. Hazardous polymerization does not occur. Explosive material under shock conditions.

SECTION 11 – TOXICOLOGICAL INFORMATION

Acute Toxicity

Product Information: Irritating to eyes. May cause skin irritation. Harmful if swallowed.

Chemical name	LD50 Oral	LD50 Dermal	LC50 Inhalation
Ammonium Nitrate	2217 mg/kg Rat	3000 mg/kg Rabbit	88.8 mg/L Rat 4 h
Sodium Nitrate	1267-4300 mg/kg Rat		
Pentaerythritol tetranitrate	1660 mg/ kg Rat		
Mineral Oil	4300 mg/kg Rat		

Subchronic Toxicity (28 Days): Sodium Nitrate; Ammonium Nitrate: Ingestion may cause methemoglobinemia. Initial manifestation of methemoglobinemia is cyanosis, characterized by navy lips, tongue and mucous membranes, with skin color being slate grey. Further manifestation is characterized by headache, weakness, dyspnea, dizziness, stupor, respiratory distress and death due to anoxia. If ingested, nitrates may be reduced to nitrites by bacteria in the digestive tract. Signs and symptoms of nitrite poisoning include methemoglobinemia, nausea, dizziness, increased heart rate, hypotension, fainting and, possibly shock.

Chronic Toxicity: May cause methemoglobinemia.

Carcinogenicity: The ingredients of this product are not classified as carcinogenic by ACGIH (American Conference of Governmental Industrial Hygienists) or IARC (International Agency for

Research on Cancer), not regulated as carcinogens by OSHA (Occupational Safety and Health Administration), and not listed as carcinogens by T\NTP (National Toxicology Program).

Mutagenic effects: There is no evidence of mutagenic potential.

Irritation: Irritating to eyes. May cause irritation of respiratory tract. May cause skin irritation in susceptible persons.

Reproductive effects: No information is available and no adverse reproductive effects are anticipated.

Developmental effects: No information is available and no adverse developmental effects are anticipated.

Target Organ: Eyes, skin, respiratory system, blood, liver urinary tract, gastrointestinal tract (GI), endocrine system & immune system.

SECTION 12 – ECOLOGICAL INFORMATION

Ecotoxicity effects: Dissolves slowly in water. Harmful to aquatic life at low concentrations.
Environmental Effects: Can be dangerous if allowed to enter drinking water intakes. Do not contaminate domestic or irrigation water supplies, lakes, streams, ponds, or rivers.

Chemical Name	Freshwater Algae Data	Freshwater Fish Species Data	Microtox Data	Water Flea Data	log Pow
Sodium Nitrate					-3.8

Persistence/Degradability: Some water resistance but soluble with extended time periods.

Mobility in Environmental media: Dissolves slowly in water

SECTION 13 – DISPOSAL CONSIDERATIONS

Waste Disposal Method: Burn under supervision of an expert at an explosive burning ground or destroy by detonation in boreholes, in accordance with applicable local, provincial and federal regulations. Call upon the services of an Orica Technical Representative.

SECTION 14 – TRANSPORT INFORMATION

DOT Proper Shipping Name: Explosive, blasting type E
Hazard Class: 1.1D
UN-No: UN0241
Packing group: II
TDG Proper Shipping Name: Explosive, blasting type E
Hazard Class: 1.1D
UN-No: UN0241
Packing group: II

Transportation Emergency Telephone Number: 1-877-561-3636 or CHEMTREC: 1-800-424-9300

SECTION 15 – REGULATORY INFORMATION

CANADIAN CLASSIFICATION: This product has been classified in accordance with the hazard criteria of the CPR (Controlled Products Regulations) and this MSDS contains all the information required by the CPR

WHMIS hazard class: This product is an explosive and is not regulated by WHMIS.

USA CLASSIFICATION:

SARA Regulations Sections 313 and 40 CFR 372: This product contains the following toxic chemical(s) subject to reporting requirements, Ammonium Nitrate (6484-52-2), Pentaerythritol Tetranitrate (78-11-5), Sodium Nitrate (7631-99-4) & Mineral Oil (64742-53-6).

SARA 311/312 Hazardous Categorization

Acute Heath Hazard: Yes
Chronic Health Hazard: Yes
Fire Hazard: No
Reactive Hazard: Yes
Sudden Release of Pressure Hazard: Yes

Ozone Protection and 40 CFR 42: No reportable quantities of ozone depleting agents

Other Regulations/Legislations which apply to this product: New Jersey Right-to-Know, Pennsylvania Right-to-Know, Massachusetts Right-to-Know, Rhode Island Right-to-Know, Florida, New Jersey Special Health Hazard Substance List, Minnesota Hazardous Substance List, California Director's List of Hazardous Substances, California Proposition 65.

TSCA: Complies **DSL:** Complies **NDSL:** Complies

The components in the product are on the following international inventory lists:

Chemical Name	TSCA	DSL	NDSL	ENCS	EINECS	ELINCS	CHINA	KECL	PICCS	AICS
Ammonium Nitrate	X	X	-	X	X	-	X	X	X	X
Sodium Nitrate	X	X	-	X	X	X	X	X	X	X
Pentaerythritol Tetranitrate	X	X	-	X	X	-	-	X	-	X
Mineral Oil	X	X	-	-	X	-	X	X	X	X

Legend: X – Listed

SECTION 16 – OTHER INFORMATION

Prepared by: **Safety Health & Environment**
303-268-5000

Preparation Date: 10-Sep-2005
Revision Date: 18-Jul-2008

The information contained herein is offered only as guide to the handling of this specific material and has been prepared in good faith by technically knowledgeable personnel. It is not intended to be all-inclusive and the manner and conditions of use and handling may involve other and additional considerations. No warranty of any kind is given or implied and Orica will not be liable for any damages, losses, injuries or consequential damages which may result from the use of or reliance on any information contained herein.

End of MSDS

Material Safety Data Sheet

Preparation Date: 19-Jul-2007 **Revision Date:** 22-Oct-2008 **Revision Number:** 1

SECTION 1 – PRODUCT AND COMPANY INFORMATION

Supplier(s):

Orica Canada Inc.
Maple Street
Brownsburg, QC
For MSDS Requests: 1-450-533-4201

Orica USA Inc
33101 E Quincy Ave
Watkins, CO 80137-9406
For MSDS Requests: 1-303-268-5000

Product Name: **Exel™ Lead-In-Line™, Exel™ Shock Tube™ (Bulk)**
Product Code: 20015
Alternate Name(s): Bulk Shock Tubing
UN-No: UN0349
Recommended Use: Shock Tube for non-electric blast initiation.

Emergency Telephone Number: FOR CHEMICAL EMERGENCIES (24 HOUR) INVOLVING TRANSPORTATION, SPILL, LEAK, RELEASE, FIRE OR ACCIDENTS: **IN CANADA CALL:** ORICA CANANDA TRANSPORTATION EMERGENCY RESPONSE SYSTEM AT **1-877-561-3636**. IN US CALL: CHEMTREC **1-800-424-9300**. **IN THE U.S**. FOR LOST, STOLEN OR MISPLACED EXPLOSIVES CALL: BATF **1-800-800-3855.** FORM ATF F5400.0 MUST BE COMPLETED AND LOCAL AUTHORITIES (STATE/MUNICIPAL POLICE, ETC.) MUST BE ADVISED.

SECTION 2 – HAZARD IDENTIFICATION

Emergency Overview:
This product is an article. No exposure to hazardous chemicals is expected to occur during intended product use. Misuse of the product may result in exposure to hazardous chemicals. The following information is the potential hazards associated with the ingredient(s) in this product. It is our belief that, under conditions of normal occupational exposure, this product should pose no such hazards to the user. Main risk is that of explosion by shock, friction, fire or other sources of ignition. Read the entire MSDS for a more thorough evaluation of the hazards.

Appearance:	**Physical State:**	**Odor:**
Polyolefin tube with unspecified color	Solid	None

SECTION 3 – COMPOSITION/ INFORMATION ON INGREDIENTS

Chemical Name	**CAS-No**	**Weight %**
Cyclotetramethylenetetranitramine (HMX) / Octogen	2691-41-0	0.2 – 0.4
Aluminum	7429-90-5	<0.1

SECTION 4- FIRST AID MEASURES

General Advice: General: Not applicable; this is a packaged product that will not result in exposure to the contents under normal conditions of use.
In the event of contact, administer first aid appropriate for burns, laceration and bruises. If detonation fumes are inhaled, remove to fresh air. Give artificial respiration ONLY if breathing has stopped. Give cardiopulmonary resuscitation (CPR) if there is no breathing AND no pulse. Oxygen administration may be beneficial in this situation, but should only be administered by personnel trained in its use. Obtain medical attention IMMEDIATELY.

Eye Contact: No applicable information.
Skin Contact: No applicable information.

Inhalation: In the event those workers are overexposed to fumes and vapour resulting from detonation, remove victim from exposure and provide artificial respiration if not breathing.
Ingestion: No applicable information.
Notes to Physician: No applicable information.

SECTION 5 – FIRE-FIGHTING MEASURES

Flammable properties:	High explosive with mass detonation hazard. Expected to be sensitive to mechanical impact. Not expected to be sensitive to static discharge.
Suitable extinguishing media:	DO NOT FIGHT FIRES INVOLVING EXPLOSIVES. Evacuate surrounding areas. When controlling fire before involvement of explosives, fire-fighters should wear positive pressure self-contained breathing apparatus (SCBA) and full turnout gear. Water may be applied through fixed extinguishing system (sprinklers) as long as people need not be present for the system to operate. Water may be used on small fires.
Unsuitable extinguishing media:	DO NOT FIGHT FIRES INVOLVING EXPLOSIVES.
Specific hazards arising from the Chemical:	DO NOT FIGHT FIRES INVOLVING EXPLOSIVE MATERIALS. Immediately evacuate all personnel from the area to a safe distance. Guard against re-entry. This product is a high explosive with a mass detonation hazard. Thermal decomposition can lead to release of irritating gases and vapors.
Protective equipment and precautions for fire fighters:	As in any fire, wear self-contained breathing apparatus pressure-demand, NIOSH approved (or equivalent) and full protective gear.

SECTION 6 – ACCIDENTAL RELEASE MEASURES

Methods for containment:	No information available.
Methods for cleaning up:	Not required. Contact an Orica Canada Inc. or Orica USA Inc. Technical Representative.

SECTION 7 - HANDLING AND STORAGE

Handling:	This product is an explosive and should only be used under the supervision of trained personnel. Protect containers from physical damage. Keep away from incompatible materials, heat, sparks, flames and other ignition sources. Avoid rough handling.
Storage:	Keep container tightly closer in a dry and well-ventilated place.

SECTION 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

Engineering Measures:	Where reasonably practicable this should be achieved by the use of local exhaust ventilation and good general extraction.
Personal Protective Equipment	
Eye/Face Protection:	Tightly fitting safety goggles.
Skin Protection:	not required for normal use.
Respiratory protection:	Use a NIOSH-approved respirator, if required.
Hygiene Measures:	Handle in accordance with good industrial hygiene and safety practice.

SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES

Appearance:	Polyolefin tube with unspecified color.	**Odor:**	None
		Viscosity:	No Information Available
Physical State:	Solid	**Melting Point/Range:**	PETN melts at 140°C / 284°F
pH:	No data available		
Flammable Limits (upper):	No data available	**Flammable Limits (lower):**	No data available
Explosion Power:	No data available	**Specific Gravity:**	Not available
Water Solubility:	Negligible	**Other Solubility:**	No information available
Vapor Pressure:	Not available	**Oxidizing Properties:**	No information available
Partition Coefficient (n-octanol/water):	No data available		

SECTION 10 - STABILITY AND REACTIVITY

Stability:	Stable under recommended storage conditions.
Conditions to avoid:	Keep away from heat, sparks, flame, impact and friction.
Incompatible materials;	None.
Hazardous decomposition products:	Thermal decomposition products are toxic and may include hydrocarbons, oxides of carbon and nitrogen.
Hazardous polymerization:	Hazardous polymerization does not occur.

SECTION 11 - TOXICOLOGICAL INFORMATION

Acute Toxicity

Product Information:	This product has not been tested for toxicity. Information provided is based on the components.
Carcinogenicity:	There are no known carcinogenic chemicals in this product.
Mutagenicity:	There is no evidence of mutagenic potential.
Sensitization:	None.
Reproductive effects:	None.
Developmental effects:	None.
Target Organ:	No information available.

SECTION 12 - ECOLOGICAL INFORMATION

Ecotoxicity effects:	Contains no substances known to be hazardous to the environment or not degradable in wastewater treatment plants.

SECTION 13 - DISPOSAL CONSIDERATIONS

Waste Disposal Method:	Burn under supervision of an expert at and explosive burning ground or destroy by detonation in boreholes, in accordance with applicable local, provincial and federal regulations. Call upon the services of an Orica Technical Representative.

SECTION 14 - TRANSPORT INFORMATION

DOT Proper Shipping Name:	Articles, Explosive, N.O.S.
Hazard Class:	1.4S or Unclassified
UN-No:	UN0349
Packing Group:	II
TDG Proper Shipping Name:	Articles, Explosive, N.O.S.
Hazard Class:	1.4S or Unclassified
UN-No:	UN0349
Packing Group:	II

SECTION 15 - REGULATORY INFORMATION

CANADIAN CLASSIFICATION:	This product has been classified in accordance with the hazard criteria of the CPR (Controlled Products Regulations) and this MSDS contains all the information required by the CPR
WHMIS hazard class:	This product is an explosive and is not regulated by WHMIS.

USA CLASSIFICATION:

SARA Regulations Sections 313 and 40 CFR 372: No reportable components present

SARA 311/312 Hazardous Categorization

Acute Health Hazard:	No
Chronic Health Hazard:	No
Fire Hazard:	No
Reactive Hazard:	Yes
Sudden Release of Pressure Hazard:	No

Ozone Protection and 40 CFR 42: No reportable quantities of ozone depleting agents
Other Regulations/Legislations which apply to this product: Massachusetts Right-to-Know, Pennsylvania Right-to-Know, New Jersey Special Health Hazard Substance List

TSCA: Complies **DSL:** Complies **NDSL:** Complies

SECTION 16 - OTHER INFORMATION

Prepared By: **Safety, Health & Environment**
303-268-5000

Preparation Date: 19-May-2005
Revision Date: 22-Oct-2008

The information contained herein is offered as a guide to the handling of this specific material and has been prepared in good faith by technically knowledgeable personnel. It is not intended to be all-inclusive and the manner and conditions of use and handling may involve other and additional considerations. No warranty of any kind is given or implied and Orica will not be liable for any damages, losses, injuries or consequential damages which may result from the use of or reliance on any information contained herein.

End of MSDS

Material Safety Data Sheet

Preparation Date: 19-Jul-2007 **Revision Date:** 22-Oct-2008 **Revision Number:** 1

SECTION 1 – PRODUCT AND COMPANY INFORMATION

Supplier(s):

Orica Canada Inc.
Maple Street
Brownsburg, QC
For MSDS Requests: 1-450-533-4201

Orica USA Inc
33101 E Quincy Ave
Watkins, CO 80137-9406
For MSDS Requests: 1-303-268-5000

Product Name:	**Exel™ Connectadet™ (Detonator Assemblies Non-Electric)**
Product Code:	20063
Alternate Name(s):	Not Available
UN-No:	UN0500
Recommended Use:	Non-Electric detonators and accessory products.

Emergency Telephone Number: FOR CHEMICAL EMERGENCIES (24 HOUR) INVOLVING TRANSPORTATION, SPILL, LEAK, RELEASE, FIRE OR ACCIDENTS: **IN CANADA CALL:** ORICA CANANDA TRANSPORTATION EMERGENCY RESPONSE SYSTEM AT **1-877-561-3636**. IN US CALL: CHEMTREC **1-800-424-9300**. **IN THE U.S**. FOR LOST, STOLEN OR MISPLACED EXPLOSIVES CALL: BATF **1-800-800-3855.** FORM ATF F5400.0 MUST BE COMPLETED AND LOCAL AUTHORITIES (STATE/MUNICIPAL POLICE, ETC.) MUST BE ADVISED.

SECTION 2 – HAZARD IDENTIFICATION

Emergency Overview:
The following information is the potential hazards associated with the ingredient(s) in this product. It is our belief that, under conditions of normal occupational exposure, this product should pose no such hazards to the user. Main risk is that of explosion by shock, friction, fire or other sources of ignition. Read the entire MSDS for a more thorough evaluation of the hazards.

Appearance:	**Physical State:**	**Odor:**
A signal line (solid core/shock/tube) containing an explosive charge and a detonator.	Solid	None

SECTION 3 – COMPOSITION/ INFORMATION ON INGREDIENTS

Chemical Name	**CAS-No**	**Weight %**
Pentaerythritol Tetranitrate (PETN)	78-11-5	0-10
Lead Azide	13424-46-9	0-5
Cyclotetramethylenetetranitramine (HMX)	2691-41-0	0.2 – 0.4
Aluminum	7429-90-5	<0.1

Also- may contain a lead sheathed delay element(s); may include a delay composition.

SECTION 4- FIRST AID MEASURES

General Advice: General: Not applicable; this is a packaged product that will not result in exposure to the contents under normal conditions of use.
In the event of contact, administer first aid appropriate for burns, laceration and bruises. If detonation fumes are inhaled, remove to fresh air. Give artificial respiration ONLY if breathing has stopped. Give cardiopulmonary resuscitation (CPR) if there is no breathing AND no pulse. Oxygen administration may be beneficial in this situation, but should only be administered by personnel trained in its use. Obtain medical attention IMMEDIATELY.

Eye Contact: No applicable information.

Skin Contact: No applicable information.

Inhalation: In the event those workers are overexposed to fumes and vapour resulting from detonation, remove victim from exposure and provide artificial respiration if not breathing.

Ingestion: No applicable information.

Notes to Physician: No applicable information.

SECTION 5 – FIRE-FIGHTING MEASURES

Flammable properties: High explosive with mass detonation hazard. Expected to be sensitive to mechanical impact. Not expected to be sensitive to static discharge.

Suitable extinguishing media: DO NOT FIGHT FIRES INVOLVING EXPLOSIVES. Evacuate surrounding areas. When controlling fire before involvement of explosives, fire-fighters should wear positive pressure self-contained breathing apparatus (SCBA) and full turnout gear. Water may be applied through fixed extinguishing system (sprinklers) as long as people need not be present for the system to operate. Water may be used on small fires.

Unsuitable extinguishing media: DO NOT FIGHT FIRES INVOLVING EXPLOSIVE MATERIALS. Immediately evacuate all personnel from the area to a safe distance. Guard against re-entry. This product is a high explosive with a mass detonation hazard. Thermal decomposition can lead to release of irritating gases and vapors.

Protective equipment and precautions for fire fighters: As in any fire, wear self-contained breathing apparatus pressure-demand, NIOSH approved (or equivalent) and full protective gear.

SECTION 6 – ACCIDENTAL RELEASE MEASURES

Methods for containment: No information available.

Methods for cleaning up: Not required. If detonators are damaged, contact an Orica Canada Inc. or Orica USA Inc. technical representative. Deactivating Chemicals: Not required. If detonators are broken, contact product advisor.

SECTION 7 - HANDLING AND STORAGE

Handling: This product is an explosive and should only be used under the supervision of trained personnel. Protect containers from physical damage. Keep away from incompatible materials, heat, sparks, flames and other ignition sources. Avoid rough handling.

Storage: Store under moderate temperatures recommended by a technical services representative. Store under dry conditions in a well ventilated magazine that has been approved for either detonator storage or explosive storage. Do NOT store explosives in a detonator magazine or detonators in an explosive magazine. Keep away from heat, sparks and flames. Keep containers closed. Explosives should be kept well away from initiating explosives; protected from physical damage; separated from oxidizing materials, combustibles, and sources of heat. Keep away from incompatibles. Meet all legal requirements for shipping and magazining.

Storage Temperature: It is recommended that detonators not be stored or used at temperatures exceeding 70°C (158°F) without approved procedures to address the elevated temperatures.

SECTION 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

Other exposure guidelines: Recommendations listed in this section indicate the type of equipment that will provide protection against exposure to this product under normal conditions of use. Conditions of use, adequacy of engineering or other control measures, and actual exposure situations will dictate the need for specific protective devices at your workplace.

Engineering Measures: Full-handling precautions should be taken at all times.

Personal Protective Equipment

Eye/Face Protection: Safety glasses with side-shields are recommended to prevent eye contact.

Skin Protection: Gloves and protective clothing made from cotton should provide adequate protective.

Hygiene Measures: Handle in accordance with good industrial hygiene and safety practice.

SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES

Appearance:	A signal line (solid core/shock/tube) Containing an explosive charge and A detonator.	**Odor:**	None
		Viscosity:	No Information Available
Physical State:	Solid	**Melting Point/Range:**	PETN melts at 140°C / 284°F

pH:	No data available		
Flammable Limits (upper):	No data available	**Flammable Limits (lower):**	No data available
Explosion Power:	No data available	**Specific Gravity:**	Not available
Vapor Pressure:	Not available	**Oxidizing Properties:**	No information available
Partition Coefficient (n-octanol/water):	No data available		

SECTION 10 - STABILITY AND REACTIVITY

Stability: Can explode from impact, heat or friction. If detonators are broken, contact product advisor. PETN explodes at 190 - 210°C (374 - 410°F).

Conditions to avoid: Impact or shock. Static discharge.

Incompatible materials; Acids. Bases.

Hazardous decomposition products: Thermal decomposition products are toxic and may include lead, hydrocarbons, oxides of carbon and nitrogen. To a lesser degree, decomposition products may include oxides of lead, chromium, barium, boron and hydrogen cyanide.

SECTION 11 - TOXICOLOGICAL INFORMATION

Acute Toxicity

Subchronic Toxicity (28 days): Organic nitrates act as vasodilators; signs and symptoms of poisoning include headache, dizziness, increased heart rate, postural weakness and hypotension. Dermatitis or "drug rash" of the skin may also be observed.

Chronic toxicity: Contains no substance that is a known carcinogen.

Carcinogenicity: The ingredients of this product are not classified as carcinogenic by ACGIH (American Conference of Governmental Industrial Hygienists) or IARC (International Agency for Research on Cancer), not regulated as carcinogens by OSHA (occupational Safety and health Administration), and not listed as carcinogens by NTP (National Toxicology Program).

Reproductive effects: It is our belief that under normal conditions of use, this product should pose no reproductive hazard to the worker. Lead exposure may cause reproductive effects based on studies in laboratory animals and on human epidemiological studies.

Developmental effects: It is our belief that under normal conditions of use, this product should pose no reproductive hazard to the worker. Lead has been shown to cause congenital abnormalities and behavioral deficits in experimental animals in addition to its ability to increase the number of miscarriages, stillbirths and abortions in lead-exposed women.

Target Organ: Eyes, Skin, Cardiovascular system, Immune system.

Other adverse effects: Prolonged or repeated exposure to organic nitrates may develop a tolerance due to chronic dilation of the blood vessels. This tolerance disappears rapidly after a few days away from exposure and withdrawal symptoms consisting of angina and heart attack have been reported in chronically exposed workers. Another type of tolerance loss is the "Monday morning disease", where workers experience headaches, dizziness, postural weakness and other symptoms.

SECTION 12 - ECOLOGICAL INFORMATION

Ecotoxicity effects: Contains no substances known to be hazardous to the environment or not degradable in waste water treatment plants.

SECTION 13 - DISPOSAL CONSIDERATIONS

Waste Disposal Method: Burn under supervision of an expert at a government-approved explosive burning ground or destroy, by detonation in boreholes, in accordance with applicable local, provincial and federal laws. Call upon the services of an Orica Canada Inc. or Orica USA Inc. technical representative.

SECTION 14 - TRANSPORT INFORMATION

DOT Proper Shipping Name:	Detonator assemblies, Non-Electric
Hazard Class:	1.4S (depending on packaging)
UN-No:	UN0500
Packing Group:	II
TDG Proper Shipping Name:	Detonator assemblies, Non-Electric
Hazard Class:	1.4S (depending on packaging)
UN-No:	UN0500
Packing Group:	II

SECTION 15 - REGULATORY INFORMATION

CANADIAN CLASSIFICATION: This product has been classified in accordance with the hazard criteria of the CPR (Controlled Products Regulations) and this MSDS contains all the information required by the CPR

WHMIS hazard class: This product is an explosive and is not regulated by WHMIS.

USA CLASSIFICATION:

SARA Regulations Sections 313 and 40 CFR 372: This product contains the following toxic chemical(s) subject to reporting requirements,

SARA 311/312 Hazardous Categorization

Acute Health Hazard:	No
Chronic Health Hazard:	No
Fire Hazard:	No
Reactive Hazard:	Yes
Sudden Release of Pressure Hazard:	No

Ozone Protection and 40 CFR 42: No reportable quantities of ozone depleting agents

Other Regulations/Legislations which apply to this product: Massachusetts Right-to-Know, Pennsylvania Right-to-Know, New Jersey Right-to-Know, Rhode Island Right-to-Know.

TSCA: Complies **DSL:** Complies **NDSL:** Complies

SECTION 16 - OTHER INFORMATION

Prepared By: **Safety, Health & Environment**
303-268-5000

Preparation Date: 19-Jul-2007
Revision Date: 22-Oct-2008

The information contained herein is offered as a guide to the handling of this specific material and has been prepared in good faith by technically knowledgeable personnel. It is not intended to be all-inclusive and the manner and conditions of use and handling may involve other and additional considerations. No warranty of any kind is given or implied and Orica will not be liable for any damages, losses, injuries or consequential damages which may result from the use of or reliance on any information contained herein.

End of MSDS

Material Safety Data Sheet

Preparation Date: 19-Jul-2007 **Revision Date:** 22-Oct-2008 **Revision Number:** 1

SECTION 1 – PRODUCT AND COMPANY INFORMATION

Supplier(s):

Orica Canada Inc.
Maple Street
Brownsburg, QC
For MSDS Requests: 1-450-533-4201

Orica USA Inc
33101 E Quincy Ave
Watkins, CO 80137-9406
For MSDS Requests: 1-303-268-5000

Product Name:	**Exel™ Detonator Assemblies Non-Electric**
Product Code:	20080
Alternate Name(s):	Exel™ Constadet™, Exel™ Handidet™, Exel™ Handidet™ LP, Exel™ XE MS, Exel™ LP (W), Exel™ MS (W), Exel™ XT, & Exel™ T&D
UN-No:	UN0360 or UN 0361 (Depending on packaging)
Recommended Use:	Non-Electric detonators and accessory products.

Emergency Telephone Number: FOR CHEMICAL EMERGENCIES (24 HOUR) INVOLVING TRANSPORTATION, SPILL, LEAK, RELEASE, FIRE OR ACCIDENTS: **IN CANADA CALL:** ORICA CANANDA TRANSPORTATION EMERGENCY RESPONSE SYSTEM AT **1-877-561-3636**. IN US CALL: CHEMTREC **1-800-424-9300**. **IN THE U.S**. FOR LOST, STOLEN OR MISPLACED EXPLOSIVES CALL: BATF **1-800-800-3855.** FORM ATF F5400.0 MUST BE COMPLETED AND LOCAL AUTHORITIES (STATE/MUNICIPAL POLICE, ETC.) MUST BE ADVISED.

SECTION 2 – HAZARD IDENTIFICATION

Emergency Overview:

The following information is the potential hazards associated with the ingredient(s) in this product. It is our belief that, under conditions of normal occupational exposure, this product should pose no such hazards to the user. Main risk is that of explosion by shock, friction, fire or other sources of ignition. Read the entire MSDS for a more thorough evaluation of the hazards.

Appearance:	**Physical State:**	**Odor:**
A signal line (solid core/shock/tube) containing an explosive charge and a detonator.	Solid	None

SECTION 3 – COMPOSITION/ INFORMATION ON INGREDIENTS

Chemical Name	**CAS-No**	**Weight %**
Pentaerythritol Tetranitrate (PETN)	78-11-5	0-10
Lead Azide	13424-46-9	0-5
Cyclotetramethylenetetranitramine (HMX)	2691-41-0	0.2 – 0.4
Aluminum	7429-90-5	<0.1

Also- may contain a lead sheathed delay element(s); may include a delay composition.

SECTION 4- FIRST AID MEASURES

General Advice: General: Not applicable; this is a packaged product that will not result in exposure to the contents under normal conditions of use.
In the event of contact, administer first aid appropriate for burns, laceration and bruises. If detonation fumes are inhaled, remove to fresh air. Give artificial respiration ONLY if breathing has stopped. Give cardiopulmonary resuscitation (CPR) if there is no breathing AND no pulse. Oxygen administration may be beneficial in this situation, but should only be administered by personnel trained in its use. Obtain medical attention IMMEDIATELY.

Eye Contact: No applicable information.
Skin Contact: No applicable information.

Inhalation: In the event those workers are overexposed to fumes and vapour resulting from detonation, remove victim from exposure and provide artificial respiration if not breathing.
Ingestion: No applicable information.
Notes to Physician: No applicable information.

SECTION 5 – FIRE-FIGHTING MEASURES

Flammable properties: High explosive with mass detonation hazard. Expected to be sensitive to mechanical impact. Not expected to be sensitive to static discharge.

Suitable extinguishing media: DO NOT FIGHT FIRES INVOLVING EXPLOSIVES. Evacuate surrounding areas. When controlling fire before involvement of explosives, fire-fighters should wear positive pressure self-contained breathing apparatus (SCBA) and full turnout gear. Water may be applied through fixed extinguishing system (sprinklers) as long as people need not be present for the system to operate. Water may be used on small fires.

Unsuitable extinguishing media: DO NOT FIGHT FIRES INVOLVING EXPLOSIVE MATERIALS. Immediately evacuate all personnel from the area to a safe distance. Guard against re-entry. This product is a high explosive with a mass detonation hazard. Thermal decomposition can lead to release of irritating gases and vapors.

Protective equipment and precautions for fire fighters: As in any fire, wear self-contained breathing apparatus pressure-demand, NIOSH approved (or equivalent) and full protective gear.

SECTION 6 – ACCIDENTAL RELEASE MEASURES

Methods for containment: No information available.

Methods for cleaning up: Not required. If detonators are damaged, contact an Orica Canada Inc. or Orica USA Inc. technical representative. Deactivating Chemicals: Not required. If detonators are broken, contact product advisor.

SECTION 7 - HANDLING AND STORAGE

Handling: This product is an explosive and should only be used under the supervision of trained personnel. Protect containers from physical damage. Keep away from incompatible materials, heat, sparks, flames and other ignition sources. Avoid rough handling.

Storage: Store under moderate temperatures recommended by a technical services representative. Store under dry conditions in a well ventilated magazine that has been approved for either detonator storage or explosive storage. Do NOT store explosives in a detonator magazine or detonators in an explosive magazine. Keep away from heat, sparks and flames. Keep containers closed. Explosives should be kept well away from initiating explosives; protected from physical damage; separated from oxidizing materials, combustibles, and sources of heat. Keep away from incompatibles. Meet all legal requirements for shipping and magazining.

Storage Temperature: It is recommended that detonators not be stored or used at temperatures exceeding 70°C (158°F) without approved procedures to address the elevated temperatures.

SECTION 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

Other exposure guidelines: Recommendations listed in this section indicate the type of equipment that will provide protection against exposure to this product under normal conditions of use. Conditions of use, adequacy of engineering or other control measures, and actual exposure situations will dictate the need for specific protective devices at your workplace.

Engineering Measures: Full-handling precautions should be taken at all times.

Personal Protective Equipment

Eye/Face Protection: Safety glasses with side-shields are recommended to prevent eye contact.

Skin Protection: Gloves and protective clothing made from cotton should provide adequate protective.

Hygiene Measures: Handle in accordance with good industrial hygiene and safety practice.

SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES

Appearance:	A signal line (solid core/shock/tube) Containing an explosive charge and A detonator.	**Odor:**	None
Physical State:	Solid	**Viscosity:**	No Information Available
pH:	No data available	**Melting Point/Range:**	PETN melts at 140°C / 284°F
Flammable Limits (upper):	No data available	**Flammable Limits (lower):**	No data available

Explosion Power:	No data available	**Specific Gravity:**	Not available
Vapor Pressure:	Not available	**Oxidizing Properties:**	No information available
Partition Coefficient (n-octanol/water):	No data available		

SECTION 10 - STABILITY AND REACTIVITY

Stability: Can explode from impact, heat or friction. If detonators are broken, contact product advisor. PETN explodes at 190 - 210°C (374 - 410°F).

Conditions to avoid: Impact or shock. Static discharge.

Incompatible materials; Acids. Bases.

Hazardous decomposition products: Thermal decomposition products are toxic and may include lead, hydrocarbons, oxides of carbon and nitrogen. To a lesser degree, decomposition products may include oxides of lead, chromium, barium, boron and hydrogen cyanide.

SECTION 11 - TOXICOLOGICAL INFORMATION

Acute Toxicity

Subchronic Toxicity (28 days): Organic nitrates act as vasodilators; signs and symptoms of poisoning include headache, dizziness, increased heart rate, postural weakness and hypotension. Dermatitis or "drug rash" of the skin may also be observed.

Chronic toxicity: Contains no substance that is a known carcinogen.

Carcinogenicity: The ingredients of this product are not classified as carcinogenic by ACGIH (American Conference of Governmental Industrial Hygienists) or IARC (International Agency for Research on Cancer), not regulated as carcinogens by OSHA (occupational Safety and health Administration), and not listed as carcinogens by NTP (National Toxicology Program).

Reproductive effects: It is our belief that under normal conditions of use, this product should pose no reproductive hazard to the worker. Lead exposure may cause reproductive effects based on studies in laboratory animals and on human epidemiological studies.

Developmental effects: It is our belief that under normal conditions of use, this product should pose no reproductive hazard to the worker. Lead has been shown to cause congenital abnormalities and behavioral deficits in experimental animals in addition to its ability to increase the number of miscarriages, stillbirths and abortions in lead-exposed women.

Target Organ: Eyes, Skin, cardiovascular system, Immune system.

Other adverse effects: Prolonged or repeated exposure to organic nitrates may develop a tolerance due to chronic dilation of the blood vessels. This tolerance disappears rapidly after a few days away from exposure and withdrawal symptoms consisting of angina and heart attack have been reported in chronically exposed workers. Another type of tolerance loss is the "Monday morning disease", where workers experience headaches, dizziness, postural weakness and other symptoms.

SECTION 12 - ECOLOGICAL INFORMATION

Ecotoxicity effects: Contains no substances known to be hazardous to the environment or not degradable in waste water treatment plants.

SECTION 13 - DISPOSAL CONSIDERATIONS

Waste Disposal Method: Burn under supervision of an expert at a government-approved explosive burning ground or destroy, by detonation in boreholes, in accordance with applicable local, provincial and federal laws. Call upon the services of an Orica Canada Inc. or Orica USA Inc. technical representative.

SECTION 14 - TRANSPORT INFORMATION

DOT Proper Shipping Name:	Detonator assemblies, Non-Electric
Hazard Class:	1.1B or 1.4B (depending on packaging)
UN-No:	UN0360 or UN0361 (depending on packaging)
Packing Group:	II
TDG Proper Shipping Name:	Detonator assemblies, Non-Electric
Hazard Class:	1.1B or 1.4B (depending on packaging)
UN-No:	UN0360 or UN0361 (depending on packaging)
Packing Group:	II

SECTION 15 - REGULATORY INFORMATION

CANADIAN CLASSIFICATION: This product has been classified in accordance with the hazard criteria of the CPR (Controlled Products Regulations) and this MSDS contains all the information required by the CPR

WHMIS hazard class: This product is an explosive and is not regulated by WHMIS.

USA CLASSIFICATION:

SARA Regulations Sections 313 and 40 CFR 372: This product contains the following toxic chemical(s) subject to reporting requirements,

SARA 311/312 Hazardous Categorization

Acute Health Hazard:	No
Chronic Health Hazard:	No
Fire Hazard:	No
Reactive Hazard:	Yes
Sudden Release of Pressure Hazard:	No

Ozone Protection and 40 CFR 42: No reportable quantities of ozone depleting agents

Other Regulations/Legislations which apply to this product: Massachusetts Right-to-Know, Pennsylvania Right-to-Know, New Jersey Right-to-Know, Rhode Island Right-to-Know.

TSCA: Complies **DSL:** Complies **NDSL:** Complies

SECTION 16 - OTHER INFORMATION

Prepared By: **Safety, Health & Environment**
303-268-5000

Preparation Date: 19-Jul-2007
Revision Date: 22-Oct-2008

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End of MSDS

Material Safety Data Sheet

Preparation Date: 19-Jul-2007 **Revision Date:** 22-Oct-2008 **Revision Number:** 1

SECTION 1 – PRODUCT AND COMPANY INFORMATION

Supplier(s):

Orica Canada Inc.
Maple Street
Brownsburg, QC
For MSDS Requests: 1-450-533-4201

Orica USA Inc
33101 E Quincy Ave
Watkins, CO 80137-9406
For MSDS Requests: 1-303-268-5000

Product Name:	**Exel™ Detonator Assemblies Non-Electric**
Product Code:	20080
Alternate Name(s):	Exel™ Constadet™, Exel™ Handidet™, Exel™ Handidet™ LP, Exel™ XE MS, Exel™ LP (W), Exel™ MS (W), Exel™ XT, & Exel™ T&D
UN-No:	UN0360 or UN 0361 (Depending on packaging)
Recommended Use:	Non-Electric detonators and accessory products.

Emergency Telephone Number: FOR CHEMICAL EMERGENCIES (24 HOUR) INVOLVING TRANSPORTATION, SPILL, LEAK, RELEASE, FIRE OR ACCIDENTS: **IN CANADA CALL:** ORICA CANANDA TRANSPORTATION EMERGENCY RESPONSE SYSTEM AT **1-877-561-3636**. IN US CALL: CHEMTREC **1-800-424-9300**. **IN THE U.S**. FOR LOST, STOLEN OR MISPLACED EXPLOSIVES CALL: BATF **1-800-800-3855.** FORM ATF F5400.0 MUST BE COMPLETED AND LOCAL AUTHORITIES (STATE/MUNICIPAL POLICE, ETC.) MUST BE ADVISED.

SECTION 2 – HAZARD IDENTIFICATION

Emergency Overview:

The following information is the potential hazards associated with the ingredient(s) in this product. It is our belief that, under conditions of normal occupational exposure, this product should pose no such hazards to the user. Main risk is that of explosion by shock, friction, fire or other sources of ignition. Read the entire MSDS for a more thorough evaluation of the hazards.

Appearance:	**Physical State:**	**Odor:**
A signal line (solid core/shock/tube) containing an explosive charge and a detonator.	Solid	None

SECTION 3 – COMPOSITION/ INFORMATION ON INGREDIENTS

Chemical Name	**CAS-No**	**Weight %**
Pentaerythritol Tetranitrate (PETN)	78-11-5	0-10
Lead Azide	13424-46-9	0-5
Cyclotetramethylenetetranitramine (HMX)	2691-41-0	0.2 – 0.4
Aluminum	7429-90-5	<0.1

Also- may contain a lead sheathed delay element(s); may include a delay composition.

SECTION 4- FIRST AID MEASURES

General Advice: General: Not applicable; this is a packaged product that will not result in exposure to the contents under normal conditions of use.
In the event of contact, administer first aid appropriate for burns, laceration and bruises. If detonation fumes are inhaled, remove to fresh air. Give artificial respiration ONLY if breathing has stopped. Give cardiopulmonary resuscitation (CPR) if there is no breathing AND no pulse. Oxygen administration may be beneficial in this situation, but should only be administered by personnel trained in its use. Obtain medical attention IMMEDIATELY.

Eye Contact: No applicable information.
Skin Contact: No applicable information.

Inhalation: In the event those workers are overexposed to fumes and vapour resulting from detonation, remove victim from exposure and provide artificial respiration if not breathing.
Ingestion: No applicable information.
Notes to Physician: No applicable information.

SECTION 5 – FIRE-FIGHTING MEASURES

Flammable properties: High explosive with mass detonation hazard. Expected to be sensitive to mechanical impact. Not expected to be sensitive to static discharge.

Suitable extinguishing media: DO NOT FIGHT FIRES INVOLVING EXPLOSIVES. Evacuate surrounding areas. When controlling fire before involvement of explosives, fire-fighters should wear positive pressure self-contained breathing apparatus (SCBA) and full turnout gear. Water may be applied through fixed extinguishing system (sprinklers) as long as people need not be present for the system to operate. Water may be used on small fires.

Unsuitable extinguishing media: DO NOT FIGHT FIRES INVOLVING EXPLOSIVE MATERIALS. Immediately evacuate all personnel from the area to a safe distance. Guard against re-entry. This product is a high explosive with a mass detonation hazard. Thermal decomposition can lead to release of irritating gases and vapors.

Protective equipment and precautions for fire fighters: As in any fire, wear self-contained breathing apparatus pressure-demand, NIOSH approved (or equivalent) and full protective gear.

SECTION 6 – ACCIDENTAL RELEASE MEASURES

Methods for containment: No information available.

Methods for cleaning up: Not required. If detonators are damaged, contact an Orica Canada Inc. or Orica USA Inc. technical representative. Deactivating Chemicals: Not required. If detonators are broken, contact product advisor.

SECTION 7 - HANDLING AND STORAGE

Handling: This product is an explosive and should only be used under the supervision of trained personnel. Protect containers from physical damage. Keep away from incompatible materials, heat, sparks, flames and other ignition sources. Avoid rough handling.

Storage: Store under moderate temperatures recommended by a technical services representative. Store under dry conditions in a well ventilated magazine that has been approved for either detonator storage or explosive storage. Do NOT store explosives in a detonator magazine or detonators in an explosive magazine. Keep away from heat, sparks and flames. Keep containers closed. Explosives should be kept well away from initiating explosives; protected from physical damage; separated from oxidizing materials, combustibles, and sources of heat. Keep away from incompatibles. Meet all legal requirements for shipping and magazining.

Storage Temperature: It is recommended that detonators not be stored or used at temperatures exceeding 70°C (158°F) without approved procedures to address the elevated temperatures.

SECTION 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

Other exposure guidelines: Recommendations listed in this section indicate the type of equipment that will provide protection against exposure to this product under normal conditions of use. Conditions of use, adequacy of engineering or other control measures, and actual exposure situations will dictate the need for specific protective devices at your workplace.

Engineering Measures: Full-handling precautions should be taken at all times.

Personal Protective Equipment

Eye/Face Protection: Safety glasses with side-shields are recommended to prevent eye contact.

Skin Protection: Gloves and protective clothing made from cotton should provide adequate protective.

Hygiene Measures: Handle in accordance with good industrial hygiene and safety practice.

SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES

Appearance:	A signal line (solid core/shock/tube) Containing an explosive charge and A detonator.	**Odor:**	None
Physical State:	Solid	**Viscosity:**	No Information Available
pH:	No data available	**Melting Point/Range:**	PETN melts at 140°C / 284°F
Flammable Limits (upper):	No data available	**Flammable Limits (lower):**	No data available

Explosion Power:	No data available	**Specific Gravity:**	Not available
Vapor Pressure:	Not available	**Oxidizing Properties:**	No information available
Partition Coefficient (n-octanol/water):	No data available		

SECTION 10 - STABILITY AND REACTIVITY

Stability: Can explode from impact, heat or friction. If detonators are broken, contact product advisor. PETN explodes at 190 - 210°C (374 - 410°F).

Conditions to avoid: Impact or shock. Static discharge.

Incompatible materials; Acids. Bases.

Hazardous decomposition products: Thermal decomposition products are toxic and may include lead, hydrocarbons, oxides of carbon and nitrogen. To a lesser degree, decomposition products may include oxides of lead, chromium, barium, boron and hydrogen cyanide.

SECTION 11 - TOXICOLOGICAL INFORMATION

Acute Toxicity

Subchronic Toxicity (28 days): Organic nitrates act as vasodilators; signs and symptoms of poisoning include headache, dizziness, increased heart rate, postural weakness and hypotension. Dermatitis or "drug rash" of the skin may also be observed.

Chronic toxicity: Contains no substance that is a known carcinogen.

Carcinogenicity: The ingredients of this product are not classified as carcinogenic by ACGIH (American Conference of Governmental Industrial Hygienists) or IARC (International Agency for Research on Cancer), not regulated as carcinogens by OSHA (occupational Safety and health Administration), and not listed as carcinogens by NTP (National Toxicology Program).

Reproductive effects: It is our belief that under normal conditions of use, this product should pose no reproductive hazard to the worker. Lead exposure may cause reproductive effects based on studies in laboratory animals and on human epidemiological studies.

Developmental effects: It is our belief that under normal conditions of use, this product should pose no reproductive hazard to the worker. Lead has been shown to cause congenital abnormalities and behavioral deficits in experimental animals in addition to its ability to increase the number of miscarriages, stillbirths and abortions in lead-exposed women.

Target Organ: Eyes, Skin, cardiovascular system, Immune system.

Other adverse effects: Prolonged or repeated exposure to organic nitrates may develop a tolerance due to chronic dilation of the blood vessels. This tolerance disappears rapidly after a few days away from exposure and withdrawal symptoms consisting of angina and heart attack have been reported in chronically exposed workers. Another type of tolerance loss is the "Monday morning disease", where workers experience headaches, dizziness, postural weakness and other symptoms.

SECTION 12 - ECOLOGICAL INFORMATION

Ecotoxicity effects: Contains no substances known to be hazardous to the environment or not degradable in waste water treatment plants.

SECTION 13 - DISPOSAL CONSIDERATIONS

Waste Disposal Method: Burn under supervision of an expert at a government-approved explosive burning ground or destroy, by detonation in boreholes, in accordance with applicable local, provincial and federal laws. Call upon the services of an Orica Canada Inc. or Orica USA Inc. technical representative.

SECTION 14 - TRANSPORT INFORMATION

DOT Proper Shipping Name:	Detonator assemblies, Non-Electric
Hazard Class:	1.1B or 1.4B (depending on packaging)
UN-No:	UN0360 or UN0361 (depending on packaging)
Packing Group:	II
TDG Proper Shipping Name:	Detonator assemblies, Non-Electric
Hazard Class:	1.1B or 1.4B (depending on packaging)
UN-No:	UN0360 or UN0361 (depending on packaging)
Packing Group:	II

SECTION 15 - REGULATORY INFORMATION

CANADIAN CLASSIFICATION: This product has been classified in accordance with the hazard criteria of the CPR (Controlled Products Regulations) and this MSDS contains all the information required by the CPR

WHMIS hazard class: This product is an explosive and is not regulated by WHMIS.

USA CLASSIFICATION:

SARA Regulations Sections 313 and 40 CFR 372: This product contains the following toxic chemical(s) subject to reporting requirements,

SARA 311/312 Hazardous Categorization

Acute Health Hazard:	No
Chronic Health Hazard:	No
Fire Hazard:	No
Reactive Hazard:	Yes
Sudden Release of Pressure Hazard:	No

Ozone Protection and 40 CFR 42: No reportable quantities of ozone depleting agents

Other Regulations/Legislations which apply to this product: Massachusetts Right-to-Know, Pennsylvania Right-to-Know, New Jersey Right-to-Know, Rhode Island Right-to-Know.

TSCA: Complies **DSL:** Complies **NDSL:** Complies

SECTION 16 - OTHER INFORMATION

Prepared By: **Safety, Health & Environment**
303-268-5000

Preparation Date: 19-Jul-2007
Revision Date: 22-Oct-2008

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End of MSDS

Material Safety Data Sheet

Preparation Date: 09-Aug-2007 **Revision Date:** 11-Aug-2009 **Revision Number:** 1

SECTION 1 – PRODUCT AND COMPANY INFORMATION

Supplier(s):
Orica Canada Inc.
Maple Street
Brownsburg, QC
For MSDS Requests: 1-450-533-4201

Orica USA Inc
33101 E Quincy Ave
Watkins, CO 80137-9406
For MSDS Requests: 1-303-268-5000

Manufacturer:
BST Manufacturing, Inc.
924 Hawaii Avenue
Minden, LA. 71055
1-318-382-1226

Product Name:	**Pentex™, BST™, Osx™ & ProTECT-i™ Cast Boosters**
Product Code:	20083
Alternate Name(s):	BST™MPB, BST™-D, Pentex™ CSL, Pentex™ DUO, Pentex™ AP, Pentex™ SB, Pentex™-D, Pentex™ CD, BSX and Osx™ 8 Seismic Boosters, Osx™ 8 L Seismic Boosters, Pentex™ SL, Osx™ 8 Z Seismic Boosters, Pentex™ Avalanche DUO, Pentex™ ProTECT-i, AVR
UN-No:	UN0042
Recommended Use:	Used for initiation of explosive mixtures.

Emergency Telephone Number: FOR CHEMICAL EMERGENCIES (24 HOUR) INVOLVING TRANSPORTATION, SPILL, LEAK, RELEASE, FIRE OR ACCIDENTS: **IN CANADA CALL:** ORICA CANANDA TRANSPORTATION EMERGENCY RESPONSE SYSTEM AT **1-877-561-3636**. IN US CALL: CHEMTREC **1-800-424-9300**. **IN THE U.S**. FOR LOST, STOLEN OR MISPLACED EXPLOSIVES CALL: BATFE **1-800-800-3855.** FORM ATF F5400.0 MUST BE COMPLETED AND LOCAL AUTHORITIES (STATE/MUNICIPAL POLICE, ETC.) MUST BE ADVISED.

SECTION 2 – HAZARD IDENTIFICATION

Emergency Overview:
Danger. Risk of explosion by shock, fire or other sources of ignition. Irritating to eyes, respiratory system and skin.

Appearance:	**Physical State:**	**Odor:**
Tan to brown	Solid	None

SECTION 3 – COMPOSITION/ INFORMATION ON INGREDIENTS

Chemical Name	**CAS-No**	**Weight %**
2,4,6-Trinitrotoluene (TNT)	118-96-7	30-90
Cyclotrimethylene Trinitramine (RDX)	121-82-4	0-70
Pentaerythritol Tetranitrate (PETN)	78-11-5	0-60
Aluminum	7429-90-5	0-15
Enzymes	9014-01-1	0-5
Enzymes	9000-90-2	0-5

SECTION 4- FIRST AID MEASURES

General Advice: Not applicable; this is a packaged product that will not result in exposure to the contents under normal conditions of use. In the event of contact, administer first aid appropriate for symptoms present.

Eye Contact: Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

Skin Contact: Wash off immediately with soap and plenty of water, removing all contaminated clothes and shoes. If skin irritation persists, call a physician.

Inhalation: Move victim to fresh air. Give artificial respiration ONLY if breathing has stopped. Give cardiopulmonary resuscitation (CPR) if there is not breathing AND no pulse. Obtain medical advice IMMEDIATELY.

Ingestion: Rinse mouth. Harmful is swallowed. Seek medical attention IMMEDIATELY.

Notes to Physician: No information available.

SECTION 5 – FIRE-FIGHTING MEASURES

Flammable properties: Product burns if ignited, with possible transition to detonation. May ignite or explode if heated under confinement.

Suitable extinguishing media: DO NOT FIGHT FIRES INVOLVING EXPLOSIVES. Evacuate surrounding areas. When controlling fire before involvement of explosives, fire-fighters should wear positive pressure self-contained breathing apparatus (SCBA) and full turnout gear. Water may be applied through fixed extinguishing system (sprinklers) as long as people need not be present for the system to operate. Water may be used on small fires.

Unsuitable extinguishing media: DO NOT FIGHT FIRES INVOLVING EXPLOSIVES.

Specific hazards arising from the Chemical: DO NOT FIGHT FIRES INVOLVING EXPLOSIVE MATERIALS. Immediately evacuate all personnel from the area to a safe distance. Guard against re-entry. This product is a high explosive with a mass detonation hazard. Thermal decomposition can lead to release of irritating gases and vapors.

Protective equipment and precautions for fire fighters: As in any fire, wear self-contained breathing apparatus pressure-demand, NIOSH approved (or equivalent) and full protective gear.

SECTION 6 – ACCIDENTAL RELEASE MEASURES

Methods for containment: Collect loose or spilled solid material for storage or transport to secured magazine.

Methods for cleaning up: Review fire and explosion hazards before proceeding with clean up. Remove and protect ignition sources. Wear protective equipment during clean up. Mop up water using non-sparking tools. It is suggested that only personnel trained in Emergency Response should respond. Verify complete account of product(s). Notify authorities and follow applicable spill reporting requirements.

SECTION 7 - HANDLING AND STORAGE

Handling: This product is an explosive and should only be used under the supervision of trained personnel. Protect containers from physical damage. Keep away from incompatible materials, heat, sparks, flames and other ignition sources. Avoid rough handling.

Storage: Store under moderate temperatures recommended by a technical services representative. Store under dry conditions in a well ventilated magazine that has been approved for explosive storage. Do NOT store explosives in a detonator magazine or detonators in an explosive magazine. Keep away from heat, sparks and flames. Keep containers closed. Explosives should be kept well away from initiating explosives; protected from physical damage; separated from oxidizing materials, combustibles, and sources of heat. Keep away from incompatibles.

SECTION 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

Engineering Measures: Full-handling precautions should be taken at all times.

Personal Protective Equipment

- **Eye/Face Protection:** Safety glasses with side-shields are recommended to prevent eye contact.
- **Skin Protection:** Long sleeved clothing. Impervious gloves.
- **Respiratory protection:** Use a NIOSH-approved respirator or equivalent during post-detonation clean up operations.

Hygiene Measures: Handle in accordance with good industrial hygiene and safety practice.

SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES

Appearance:	Tan to Brown	**Odor:**	None
		Viscosity:	No information available
Physical State:	Solid	**Melting Point/Range:**	80℃/ 176℉
pH:	No data available		
Flammable Limits (upper):	No data available	**Flammable Limits (lower):**	No data available
Explosion Power:	No data available	**Specific Gravity:**	1.5-1.7 g/cc
Water Solubility:	Negligible	**Other Solubility:**	No information available

Vapor Pressure:	Not available	**Oxidizing Properties:**	No information available
Partition Coefficient (n-octanol/water):	No data available.		

SECTION 10 - STABILITY AND REACTIVITY

Stability:	Can explode from impact, heat or friction. PETN explodes at 190-210°C (374-410°F). Stable up to approximately 70°C.
Conditions to avoid:	Keep away from heat, impact and friction. Refer to Product Bulletin for proper applications and use procedures.
Incompatible materials;	Strong acids. (Nitric Acid). Strong oxidizing agents.
Hazardous decomposition products:	Carbon Monoxide & Nitrogen oxides (NO_X).

SECTION 11 - TOXICOLOGICAL INFORMATION

Acute Toxicity

Product Information:	Decomposition products may be toxic.
Carcinogenicity:	The ingredients of this product are not classified as carcinogenic by ACGIH (American Conference of Governmental Industrial hygienists) or IARC (International Agency for Research on Cancer), not regulated as carcinogens by OSHA (Occupational Safety and Health Administration), and not listed as carcinogens by T\NTP (National Toxicology Program).
Irritation:	Not applicable.
Corrosivity:	Not applicable.

SECTION 12 - ECOLOGICAL INFORMATION

Ecotoxicity effects:	Contains no substances known to be hazardous to the environment or not degradable in waste water treatment plants.

SECTION 13 - DISPOSAL CONSIDERATIONS

Waste Disposal Method:	Burn under supervision of an expert at and explosive burning ground or destroy by detonation in boreholes, in accordance with applicable local, provincial and federal regulations. Call upon the services of an Orica Canada Inc. or Orica USA Inc. Technical Representative.
Contaminated Packaging:	No information available.

SECTION 14 - TRANSPORT INFORMATION

DOT Proper Shipping Name:	Boosters, without detonator
Hazard Class:	1.1D
UN-No:	UN0042
Packing Group:	II
TDG Proper Shipping Name:	Boosters, without detonator
Hazard Class:	1.1D
UN-No:	UN0042
Packing Group:	II

SECTION 15 - REGULATORY INFORMATION

CANADIAN CLASSIFICATION:	This product has been classified in accordance with the hazard criteria of the CPR (Controlled Products Regulations) and this MSDS contains all the information required by the CPR
WHMIS hazard class:	This product is an explosive and is not regulated by WHMIS.

USA CLASSIFICATION:

SARA Regulations Sections 313 and 40 CFR 372: No reportable components present.

SARA 311/312 Hazardous Categorization

Acute Health Hazard: Yes

Chronic Health Hazard: No
Fire Hazard: Yes
Sudden Release of Pressure Hazard: Yes
Ozone Protection and 40 CFR 42: No reportable quantities of ozone depleting agents.
Other Regulations/Legislations which apply to this product: No information available.

TSCA: Complies **DSL:** Complies **NDSL:** Complies

SECTION 16 - OTHER INFORMATION

Prepared By: **Safety, Health & Environment**
303-268-5000

Preparation Date: 09-Aug-07
Revision Date: 11-Aug-2009

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End of MSDS

Material Safety Data Sheet

Preparation Date: 09-Aug-2007 **Revision Date:** 11-Aug-2009 **Revision Number:** 1

SECTION 1 – PRODUCT AND COMPANY INFORMATION

Supplier(s):
Orica Canada Inc.
Maple Street
Brownsburg, QC
For MSDS Requests: 1-450-533-4201

Orica USA Inc
33101 E Quincy Ave
Watkins, CO 80137-9406
For MSDS Requests: 1-303-268-5000

Manufacturer:
BST Manufacturing, Inc.
924 Hawaii Avenue
Minden, LA. 71055
1-318-382-1226

Product Name:	**Pentex™, BST™, Osx™ & ProTECT-i™ Cast Boosters**
Product Code:	20083
Alternate Name(s):	BST™MPB, BST™-D, Pentex™ CSL, Pentex™ DUO, Pentex™ AP, Pentex™ SB, Pentex™-D, Pentex™ CD, BSX and Osx™ 8 Seismic Boosters, Osx™ 8 L Seismic Boosters, Pentex™ SL, Osx™ 8 Z Seismic Boosters, Pentex™ Avalanche DUO, Pentex™ ProTECT-i, AVR
UN-No:	UN0042
Recommended Use:	Used for initiation of explosive mixtures.

Emergency Telephone Number: FOR CHEMICAL EMERGENCIES (24 HOUR) INVOLVING TRANSPORTATION, SPILL, LEAK, RELEASE, FIRE OR ACCIDENTS: **IN CANADA CALL:** ORICA CANANDA TRANSPORTATION EMERGENCY RESPONSE SYSTEM AT **1-877-561-3636**. IN US CALL: CHEMTREC **1-800-424-9300**. **IN THE U.S**. FOR LOST, STOLEN OR MISPLACED EXPLOSIVES CALL: BATFE **1-800-800-3855.** FORM ATF F5400.0 MUST BE COMPLETED AND LOCAL AUTHORITIES (STATE/MUNICIPAL POLICE, ETC.) MUST BE ADVISED.

SECTION 2 – HAZARD IDENTIFICATION

Emergency Overview:
Danger. Risk of explosion by shock, fire or other sources of ignition. Irritating to eyes, respiratory system and skin.

Appearance:	**Physical State:**	**Odor:**
Tan to brown	Solid	None

SECTION 3 – COMPOSITION/ INFORMATION ON INGREDIENTS

Chemical Name	**CAS-No**	**Weight %**
2,4,6-Trinitrotoluene (TNT)	118-96-7	30-90
Cyclotrimethylene Trinitramine (RDX)	121-82-4	0-70
Pentaerythritol Tetranitrate (PETN)	78-11-5	0-60
Aluminum	7429-90-5	0-15
Enzymes	9014-01-1	0-5
Enzymes	9000-90-2	0-5

SECTION 4- FIRST AID MEASURES

General Advice: Not applicable; this is a packaged product that will not result in exposure to the contents under normal conditions of use. In the event of contact, administer first aid appropriate for symptoms present.

Eye Contact: Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

Skin Contact: Wash off immediately with soap and plenty of water, removing all contaminated clothes and shoes. If skin irritation persists, call a physician.

Inhalation: Move victim to fresh air. Give artificial respiration ONLY if breathing has stopped. Give cardiopulmonary resuscitation (CPR) if there is not breathing AND no pulse. Obtain medical advice IMMEDIATELY.

Ingestion: Rinse mouth. Harmful is swallowed. Seek medical attention IMMEDIATELY.

Notes to Physician: No information available.

SECTION 5 – FIRE-FIGHTING MEASURES

Flammable properties: Product burns if ignited, with possible transition to detonation. May ignite or explode if heated under confinement.

Suitable extinguishing media: DO NOT FIGHT FIRES INVOLVING EXPLOSIVES. Evacuate surrounding areas. When controlling fire before involvement of explosives, fire-fighters should wear positive pressure self-contained breathing apparatus (SCBA) and full turnout gear. Water may be applied through fixed extinguishing system (sprinklers) as long as people need not be present for the system to operate. Water may be used on small fires.

Unsuitable extinguishing media: DO NOT FIGHT FIRES INVOLVING EXPLOSIVES.

Specific hazards arising from the Chemical: DO NOT FIGHT FIRES INVOLVING EXPLOSIVE MATERIALS. Immediately evacuate all personnel from the area to a safe distance. Guard against re-entry. This product is a high explosive with a mass detonation hazard. Thermal decomposition can lead to release of irritating gases and vapors.

Protective equipment and precautions for fire fighters: As in any fire, wear self-contained breathing apparatus pressure-demand, NIOSH approved (or equivalent) and full protective gear.

SECTION 6 – ACCIDENTAL RELEASE MEASURES

Methods for containment: Collect loose or spilled solid material for storage or transport to secured magazine.

Methods for cleaning up: Review fire and explosion hazards before proceeding with clean up. Remove and protect ignition sources. Wear protective equipment during clean up. Mop up water using non-sparking tools. It is suggested that only personnel trained in Emergency Response should respond. Verify complete account of product(s). Notify authorities and follow applicable spill reporting requirements.

SECTION 7 - HANDLING AND STORAGE

Handling: This product is an explosive and should only be used under the supervision of trained personnel. Protect containers from physical damage. Keep away from incompatible materials, heat, sparks, flames and other ignition sources. Avoid rough handling.

Storage: Store under moderate temperatures recommended by a technical services representative. Store under dry conditions in a well ventilated magazine that has been approved for explosive storage. Do NOT store explosives in a detonator magazine or detonators in an explosive magazine. Keep away from heat, sparks and flames. Keep containers closed. Explosives should be kept well away from initiating explosives; protected from physical damage; separated from oxidizing materials, combustibles, and sources of heat. Keep away from incompatibles.

SECTION 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

Engineering Measures: Full-handling precautions should be taken at all times.

Personal Protective Equipment

- **Eye/Face Protection:** Safety glasses with side-shields are recommended to prevent eye contact.
- **Skin Protection:** Long sleeved clothing. Impervious gloves.
- **Respiratory protection:** Use a NIOSH-approved respirator or equivalent during post-detonation clean up operations.

Hygiene Measures: Handle in accordance with good industrial hygiene and safety practice.

SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES

Appearance:	Tan to Brown	**Odor:**	None
		Viscosity:	No information available
Physical State:	Solid	**Melting Point/Range:**	80℃/ 176℉
pH:	No data available		
Flammable Limits (upper):	No data available	**Flammable Limits (lower):**	No data available
Explosion Power:	No data available	**Specific Gravity:**	1.5-1.7 g/cc
Water Solubility:	Negligible	**Other Solubility:**	No information available

Vapor Pressure:	Not available	**Oxidizing Properties:**	No information available
Partition Coefficient (n-octanol/water):	No data available.		

SECTION 10 - STABILITY AND REACTIVITY

Stability:	Can explode from impact, heat or friction. PETN explodes at 190-210°C (374-410°F). Stable up to approximately 70°C.
Conditions to avoid:	Keep away from heat, impact and friction. Refer to Product Bulletin for proper applications and use procedures.
Incompatible materials;	Strong acids. (Nitric Acid). Strong oxidizing agents.
Hazardous decomposition products:	Carbon Monoxide & Nitrogen oxides (NO_X).

SECTION 11 - TOXICOLOGICAL INFORMATION

Acute Toxicity

Product Information:	Decomposition products may be toxic.
Carcinogenicity:	The ingredients of this product are not classified as carcinogenic by ACGIH (American Conference of Governmental Industrial hygienists) or IARC (International Agency for Research on Cancer), not regulated as carcinogens by OSHA (Occupational Safety and Health Administration), and not listed as carcinogens by T\NTP (National Toxicology Program).
Irritation:	Not applicable.
Corrosivity:	Not applicable.

SECTION 12 - ECOLOGICAL INFORMATION

Ecotoxicity effects:	Contains no substances known to be hazardous to the environment or not degradable in waste water treatment plants.

SECTION 13 - DISPOSAL CONSIDERATIONS

Waste Disposal Method:	Burn under supervision of an expert at and explosive burning ground or destroy by detonation in boreholes, in accordance with applicable local, provincial and federal regulations. Call upon the services of an Orica Canada Inc. or Orica USA Inc. Technical Representative.
Contaminated Packaging:	No information available.

SECTION 14 - TRANSPORT INFORMATION

DOT Proper Shipping Name:	Boosters, without detonator
Hazard Class:	1.1D
UN-No:	UN0042
Packing Group:	II
TDG Proper Shipping Name:	Boosters, without detonator
Hazard Class:	1.1D
UN-No:	UN0042
Packing Group:	II

SECTION 15 - REGULATORY INFORMATION

CANADIAN CLASSIFICATION:	This product has been classified in accordance with the hazard criteria of the CPR (Controlled Products Regulations) and this MSDS contains all the information required by the CPR
WHMIS hazard class:	This product is an explosive and is not regulated by WHMIS.

USA CLASSIFICATION:

SARA Regulations Sections 313 and 40 CFR 372: No reportable components present.

SARA 311/312 Hazardous Categorization

Acute Health Hazard: Yes

Chronic Health Hazard: No
Fire Hazard: Yes
Sudden Release of Pressure Hazard: Yes
Ozone Protection and 40 CFR 42: No reportable quantities of ozone depleting agents.
Other Regulations/Legislations which apply to this product: No information available.

TSCA: Complies **DSL:** Complies **NDSL:** Complies

SECTION 16 - OTHER INFORMATION

Prepared By: **Safety, Health & Environment**
303-268-5000

Preparation Date: 09-Aug-07
Revision Date: 11-Aug-2009

The information contained herein is offered as a guide to the handling of this specific material and has been prepared in good faith by technically knowledgeable personnel. It is not intended to be all-inclusive and the manner and conditions of use and handling may involve other and additional considerations. No warranty of any kind is given or implied and Orica will not be liable for any damages, losses, injuries or consequential damages which may result from the use of or reliance on any information contained herein.

End of MSDS

Material Safety Data Sheet

Preparation Date: 21-May-2005 **Revision Date:** 23-Jun-2009 **Revision Number:** 1

SECTION 1 – PRODUCT AND COMPANY IDENTIFICATION

Supplier(s):

Orica Canada Inc.
Maple Street
Brownsburg, QC
For MSDS Requests: 1-450-533-4201

Orica USA Inc.
33101 E. Quincy Avenue
Watkins, CO 80137-9406
For MSDS Requests: 1 303-268-5000

Product Name:	**B-line™, Boostercord™, Cordtex™, Powercord™, Primaflex™**
Product Code:	40040
Alternate Name(s):	Uniline, B-Line, Trunkline, Powercord 100, Powercord 150, Powercord 200, Powercord O 200, Boostercord, Primaflex, Anoline, X-245, X-247, Cordtex 7.5, Cordtex SHD, Cordtex 15, Cordtex LT, Cordtex AP, Cordtex 18, Cordtex 25, Cordtex Premium, Cordtex 40, Cordtex TL, Cordtex 50, Cordtex XTL, Cordtex 60, T-line, Special, 4400 M/S, Poly, Low Flash 25
UN-No:	UN0065
Recommended Use:	Used for initiation of explosive mixtures.

Emergency Telephone Number: FOR CHEMICAL EMERGENCIES (24 HOUR) INVOLVING TRANSPORTATION, SPILL, LEAK, RELEASE, FIRE OR ACCIDENTS: **IN CANADA CALL:** THE ORICA TRANSPORTATION EMERGENCY RESPONSE SYSTEM AT **1-877-561-3636. IN THE U.S. CALL: CHEMTREC 1-800-424-9300. IN THE U.S.:** FOR LOST, STOLEN, OR MISPLACED EXPLOSIVES CALL: BATF **1-800-800-3855.** FORM ATF F 5400.0 MUST BE COMPLETED AND LOCAL AUTHORITIES (STATE/MUNICIPAL POLICE, ETC.) MUST BE ADVISED.

SECTION 2 – HAZARD IDENTIFICATION

Emergency Overview:
Danger. Risk of explosion by shock, fire or other sources of ignition. Irritating to eyes, respiratory system and skin.

Appearance:	**Physical State:**	**Odor:**
Cords covered with PVC or polyethylene plastic and/ or wax textiles	Solid	Odorless

SECTION 3 – COMPOSITION/ INFORMATION ON INGREDIENTS

Chemical Name	**CAS-No**	**Weight %**
Pentaerythritol Tetranitrate (PETN)	78-11-5	60-100

SECTION 4 – FIRST AID MEASURES

General Advice:	Not applicable; this is a packaged product that will not result in exposure to the contents under normal conditions of use. In the event of contact, administer first aid appropriate for symptoms present.
Eye Contact:	Immediately flush with plenty of water. After initial flushing, remove any contact lenses and continue flushing for at least 15 minutes. Immediate medical attention is required.
Skin Contact:	Wash off immediately with soap and plenty of water, removing all contaminated clothes and shoes. If skin irritation persists, call a physician.
Inhalation:	Move victim to fresh air. Give artificial respiration ONLY if breathing has stopped. Give cardiopulmonary resuscitation (CPR) if there is not breathing AND no pulse. Obtain medical advice IMMEDIATELY.
Ingestion:	Immediate medical attention is required. Do no induce vomiting. Clean mouth with water and afterwards drink plenty of water. If spontaneous vomiting occurs, have victim lean forward with head positioned to avoid breathing in of vomitus, rinse mouth and administer more water. Never give anything by mouth to and unconscious person.

Notes to physician: Symptomatic. Administer oxygen if there are signs of cyanosis. If clinical condition deteriorates, administer 10cc Methylene Blue intravenously. It is unlikely for this to be required with methemoglobin level of less than 40%.

SECTION 5 – FIRE-FIGHTING MEASURES

Flammable properties: Product burns if ignited, with possible transition to detonation. May ignite or explode if heated under confinement.

Suitable extinguishing media: DO NOT FIGHT FIRES INVOLVING EXPLOSIVES. Evacuate surrounding areas. When controlling fire before involvement of explosives, fire-fighters should wear positive pressure self-containing breathing apparatus (SCBA) and full turnout gear. Water may be applied through fixed extinguishing system (sprinklers) as long as people need not be present for the system to operate.

Unsuitable extinguishing media: DO NOT FIGHT FIRES INVOLVING EXPLOSIVES. Attempts to smother a fire involving this product will be ineffective as it is its own oxygen source. Smother this product could leat to decomposition and explosion. This product is more sensitive to detonation if contaminated with organic or oxidisable material or if heated while confined. Unless the mass of product on fire is flooded with water, re-ignition is possible.

Specific hazards arising from the chemical: This product is a high explosive with mass detonation hazard. DO NOT FIGHT FIRES INVOLVING EXPLOSIVE MATERIALS. Immediately evacuate all personnel from the area to a safe distance. Guard against re-entry. Thermal decomposition can lead to release of irritating gases and vapors.

Protective equipment and precautions for firefighters: As in any fire, wear self-contained breathing apparatus pressure-demand, NIOSH approved (or equivalent) and full protective gear.

SECTION 6 – ACCIDENTAL RELEASE MEASURES

Methods for containment: No information available.

Methods for cleaning up: Review fire and explosion hazards before proceeding with clean up. Remove and protect ignition sources. Wear protective equipment during clean up. Mop up water using non-sparking tools. It is suggested that only personnel trained in Emergency Response should respond. Verify complete account of product(s). Notify authorities and follow applicable spill reporting requirements.

SECTION 7 – HANDLING AND STORAGE

Handling: This product is an explosive and should only be used under the supervision of trained personnel. Protect containers from physical damage. Keep away from incompatible materials, heat, sparks, flames and other ignition sources. Avoid rough handling.

Storage: Store under moderate temperatures recommended by a technical services representative. Store under dry conditions in a well ventilated magazine that has been approved for either detonator storage or explosive storage. Do NOT store explosives in a detonator magazine or detonators in an explosive magazine. Keep away from heat, sparks and flames. Keep containers closed. Explosives should be kept well away from initiating explosives; protected from physical damage; separated from oxidizing materials, combustibles, and sources of heat. Keep away from incompatibles.

SECTION 8 – EXPOSURE CONTROLS/ PERSONAL PROTECTION

Engineering Measures: Full-handling precautions should be taken at all times.

Personal Protective Equipment

- **Eye/Face Protection:** Tightly fitting safety goggles
- **Skin Protection:** Long sleeved clothing.
- **Respiratory Protection:** No special protective equipment required.

Hygiene Measures: Handle in accordance with good industrial hygiene and safety practice.

SECTION 9 – PHYSICAL AND CHEMICAL PROPERTIES

Appearance:	Cords covered with PVC or polyethylene plastic and/or wax and textiles	**Odor:**	None
Physical State:	Solid	**Viscosity:**	No information available
pH:	No data available	**Flash Point:**	Not applicable
Autoignition Temperature:	No data available	**Boiling Point/Range:**	Not applicable
Melting Point/Range:	No data available	**Flammable Limits (Upper):**	Not applicable
Flammable Limits (Lower):	Not applicable	**Explosion Power:**	No data available
Specific Gravity:	No data available	**Water Solubility:**	Negligible
Other Solubility:	Not applicable	**Vapor Pressure:**	No data available
Oxidizing Properties:	Not available	**Partition Coefficient (n-octanol/water):**	No data available

SECTION 10 – STABILITY AND REACTIVITY

Stability: Can explode from impact, heat or friction. PETN explodes at 190 - 210°C (374 410°F). Stable up to approximately 70°C.

Conditions to avoid: Keep away from heat, impact, and friction. Some cords have limited tensile strength and abrasion resistance. Refer to the Product Bulletin for proper applications and use procedures. Damaged cords can lead to misfired holes - potentially, the most hazardous of all blasting situations. Avoid abrasion of cord on hole collars or casing pipes.

Incompatible materials: Strong oxidizing agents, The PVC/polyethylene plastic or wax covering will, in time, be affected by diesel oil.

Hazardous decomposition products: Carbon oxide. Nitrogen oxides (NOx). Hydrocarbons.

SECTION 11 – TOXICOLOGICAL INFORMATION

Acute Toxicity

Product Information: Irritating to eyes. May cause skin irritation. Harmful if swallowed.

Chronic Toxicity: Not available.

Carcinogenicity: The ingredients of this product are not classified as carcinogenic by ACGIH (American Conference of Governmental Industrial Hygienists) or IARC (International Agency for Research on Cancer), not regulated as carcinogens by OSHA (Occupational Safety and Health Administration), and not listed as carcinogens by T\NTP (National Toxicology Program).

Mutagenic effects: There is no evidence of mutagenic potential.

Irritation: Irritating to eyes. May cause irritation of respiratory tract. May cause skin irritation in susceptible persons.

Reproductive effects: No information is available and no adverse reproductive effects are anticipated.

Developmental effects: No information is available and no adverse developmental effects are anticipated.

Target Organ: Eyes, skin, respiratory system, blood, liver, urinary tract, gastrointestinal tract (GI), endocrine system, & immune system.

SECTION 12 – ECOLOGICAL INFORMATION

Ecotoxicity effects: There is no known ecological information for this product.

Persistence/Degradability: Not applicable.

Mobility in Environmental media: Not applicable.

SECTION 13 – DISPOSAL CONSIDERATIONS

Waste Disposal Method: Burn under supervision of an expert at an explosive burning ground or destroy by detonation in boreholes, in accordance with applicable local, provincial and federal regulations. Call upon the services of an Orica Technical Representative.

SECTION 14 – TRANSPORT INFORMATION

DOT Proper Shipping Name:	Cord, Detonating
Hazard Class:	1.1D
UN-No:	UN0065
Packing group:	II
TDG Proper Shipping Name:	Cord, Detonating
Hazard Class:	1.1D
UN-No:	UN0065
Packing group:	II

SECTION 15 – REGULATORY INFORMATION

CANADIAN CLASSIFICATION: This product has been classified in accordance with the hazard criteria of the CPR (Controlled Products Regulations) and this MSDS contains all the information required by the CPR

WHMIS hazard class: This product is an explosive and is not regulated by WHMIS.

USA CLASSIFICATION:

SARA Regulations Sections 313 and 40 CFR 372: This product contains the following toxic chemical(s) subject to reporting requirements,

SARA 311/312 Hazardous Categorization

Acute Heath Hazard:	No
Chronic Health Hazard:	No
Fire Hazard:	No
Reactive Hazard:	Yes
Sudden Release of Pressure Hazard:	No

Ozone Protection and 40 CFR 42: No reportable quantities of ozone depleting agents

Other Regulations/Legislations which apply to this product: No information available.

TSCA: Complies **DSL:** Complies **NDSL:** Complies

SECTION 16 – OTHER INFORMATION

Prepared by: **Safety Health & Environment**
303-268-5000

Preparation Date: 21-May-2005
Revision Date: 23-Jun-2009

REFERENCES:

RTECS-Registry of Toxic Effects of Chemical Substances, CCINFOdisc, Canadian Centre for Occupational Health and Safety, National Institute for Occupational Safety and Health, U.S. Dept. of Health & Human Services, Cincinnati, 1998.

Clayton, G.D. and Clayton, F.E., Eds., Patty's Industrial Hygiene and Toxicology, 3rd ed., Vol. IIA, B, C, John Wiley and Sons, New York, 1981.

Supplier's Material Safety Data Sheets.

CHEMINFO, HSDB, & NIOSH through "CCINFOdisc", Canadian Centre for Occupational Health and Safety, Hamilton, Ontario, Canada, 1998.

"CHEMINFO", "CHRIS", "TOG", "DOT", through "CCINFOdisc", Occupational Health and Safety, Hamilton, Ontario, Canada.

Documentation of the Threshold Limit Values and Biological Exposure Indices, 5th ed., American Conference of Governmental Industrial Hygienists Inc., Cincinnati, 1986.

Threshold Limit Values and Biological Exposure Indices for 1997, American Conference of Governmental Industrial Hygienists, Cincinnati, 1997.

Windholz, Martha, Ed., The Merck Index, 11 th ed., Merck and Co., Inc., Rahway, New Jersey, 1989

End of MSDS

Material Safety Data Sheet

Preparation Date: 21-May-2005 **Revision Date:** 23-Jun-2009 **Revision Number:** 1

SECTION 1 – PRODUCT AND COMPANY IDENTIFICATION

Supplier(s):

Orica Canada Inc.
Maple Street
Brownsburg, QC
For MSDS Requests: 1-450-533-4201

Orica USA Inc.
33101 E. Quincy Avenue
Watkins, CO 80137-9406
For MSDS Requests: 1 303-268-5000

Product Name:	**B-line™, Boostercord™, Cordtex™, Powercord™, Primaflex™**
Product Code:	40040
Alternate Name(s):	Uniline, B-Line, Trunkline, Powercord 100, Powercord 150, Powercord 200, Powercord O 200, Boostercord, Primaflex, Anoline, X-245, X-247, Cordtex 7.5, Cordtex SHD, Cordtex 15, Cordtex LT, Cordtex AP, Cordtex 18, Cordtex 25, Cordtex Premium, Cordtex 40, Cordtex TL, Cordtex 50, Cordtex XTL, Cordtex 60, T-line, Special, 4400 M/S, Poly, Low Flash 25
UN-No:	UN0065
Recommended Use:	Used for initiation of explosive mixtures.

Emergency Telephone Number: FOR CHEMICAL EMERGENCIES (24 HOUR) INVOLVING TRANSPORTATION, SPILL, LEAK, RELEASE, FIRE OR ACCIDENTS: **IN CANADA CALL:** THE ORICA TRANSPORTATION EMERGENCY RESPONSE SYSTEM AT **1-877-561-3636. IN THE U.S. CALL: CHEMTREC 1-800-424-9300. IN THE U.S.:** FOR LOST, STOLEN, OR MISPLACED EXPLOSIVES CALL: BATF **1-800-800-3855.** FORM ATF F 5400.0 MUST BE COMPLETED AND LOCAL AUTHORITIES (STATE/MUNICIPAL POLICE, ETC.) MUST BE ADVISED.

SECTION 2 – HAZARD IDENTIFICATION

Emergency Overview:
Danger. Risk of explosion by shock, fire or other sources of ignition. Irritating to eyes, respiratory system and skin.

Appearance:	**Physical State:**	**Odor:**
Cords covered with PVC or polyethylene plastic and/ or wax textiles	Solid	Odorless

SECTION 3 – COMPOSITION/ INFORMATION ON INGREDIENTS

Chemical Name	**CAS-No**	**Weight %**
Pentaerythritol Tetranitrate (PETN)	78-11-5	60-100

SECTION 4 – FIRST AID MEASURES

General Advice:	Not applicable; this is a packaged product that will not result in exposure to the contents under normal conditions of use. In the event of contact, administer first aid appropriate for symptoms present.
Eye Contact:	Immediately flush with plenty of water. After initial flushing, remove any contact lenses and continue flushing for at least 15 minutes. Immediate medical attention is required.
Skin Contact:	Wash off immediately with soap and plenty of water, removing all contaminated clothes and shoes. If skin irritation persists, call a physician.
Inhalation:	Move victim to fresh air. Give artificial respiration ONLY if breathing has stopped. Give cardiopulmonary resuscitation (CPR) if there is not breathing AND no pulse. Obtain medical advice IMMEDIATELY.
Ingestion:	Immediate medical attention is required. Do no induce vomiting. Clean mouth with water and afterwards drink plenty of water. If spontaneous vomiting occurs, have victim lean forward with head positioned to avoid breathing in of vomitus, rinse mouth and administer more water. Never give anything by mouth to and unconscious person.

Notes to physician: Symptomatic. Administer oxygen if there are signs of cyanosis. If clinical condition deteriorates, administer 10cc Methylene Blue intravenously. It is unlikely for this to be required with methemoglobin level of less than 40%.

SECTION 5 – FIRE-FIGHTING MEASURES

Flammable properties: Product burns if ignited, with possible transition to detonation. May ignite or explode if heated under confinement.

Suitable extinguishing media: DO NOT FIGHT FIRES INVOLVING EXPLOSIVES. Evacuate surrounding areas. When controlling fire before involvement of explosives, fire-fighters should wear positive pressure self-containing breathing apparatus (SCBA) and full turnout gear. Water may be applied through fixed extinguishing system (sprinklers) as long as people need not be present for the system to operate.

Unsuitable extinguishing media: DO NOT FIGHT FIRES INVOLVING EXPLOSIVES. Attempts to smother a fire involving this product will be ineffective as it is its own oxygen source. Smother this product could leat to decomposition and explosion. This product is more sensitive to detonation if contaminated with organic or oxidisable material or if heated while confined. Unless the mass of product on fire is flooded with water, re-ignition is possible.

Specific hazards arising from the chemical: This product is a high explosive with mass detonation hazard. DO NOT FIGHT FIRES INVOLVING EXPLOSIVE MATERIALS. Immediately evacuate all personnel from the area to a safe distance. Guard against re-entry. Thermal decomposition can lead to release of irritating gases and vapors.

Protective equipment and precautions for firefighters: As in any fire, wear self-contained breathing apparatus pressure-demand, NIOSH approved (or equivalent) and full protective gear.

SECTION 6 – ACCIDENTAL RELEASE MEASURES

Methods for containment: No information available.

Methods for cleaning up: Review fire and explosion hazards before proceeding with clean up. Remove and protect ignition sources. Wear protective equipment during clean up. Mop up water using non-sparking tools. It is suggested that only personnel trained in Emergency Response should respond. Verify complete account of product(s). Notify authorities and follow applicable spill reporting requirements.

SECTION 7 – HANDLING AND STORAGE

Handling: This product is an explosive and should only be used under the supervision of trained personnel. Protect containers from physical damage. Keep away from incompatible materials, heat, sparks, flames and other ignition sources. Avoid rough handling.

Storage: Store under moderate temperatures recommended by a technical services representative. Store under dry conditions in a well ventilated magazine that has been approved for either detonator storage or explosive storage. Do NOT store explosives in a detonator magazine or detonators in an explosive magazine. Keep away from heat, sparks and flames. Keep containers closed. Explosives should be kept well away from initiating explosives; protected from physical damage; separated from oxidizing materials, combustibles, and sources of heat. Keep away from incompatibles.

SECTION 8 – EXPOSURE CONTROLS/ PERSONAL PROTECTION

Engineering Measures: Full-handling precautions should be taken at all times.

Personal Protective Equipment

- **Eye/Face Protection:** Tightly fitting safety goggles
- **Skin Protection:** Long sleeved clothing.
- **Respiratory Protection:** No special protective equipment required.

Hygiene Measures: Handle in accordance with good industrial hygiene and safety practice.

SECTION 9 – PHYSICAL AND CHEMICAL PROPERTIES

Appearance:	Cords covered with PVC or polyethylene plastic and/or wax and textiles	**Odor:**	None
Physical State:	Solid	**Viscosity:**	No information available
pH:	No data available	**Flash Point:**	Not applicable
Autoignition Temperature:	No data available	**Boiling Point/Range:**	Not applicable
Melting Point/Range:	No data available	**Flammable Limits (Upper):**	Not applicable
Flammable Limits (Lower):	Not applicable	**Explosion Power:**	No data available
Specific Gravity:	No data available	**Water Solubility:**	Negligible
Other Solubility:	Not applicable	**Vapor Pressure:**	No data available
Oxidizing Properties:	Not available	**Partition Coefficient (n-octanol/water):**	No data available

SECTION 10 – STABILITY AND REACTIVITY

Stability: Can explode from impact, heat or friction. PETN explodes at 190 - 210°C (374 410°F). Stable up to approximately 70°C.

Conditions to avoid: Keep away from heat, impact, and friction. Some cords have limited tensile strength and abrasion resistance. Refer to the Product Bulletin for proper applications and use procedures. Damaged cords can lead to misfired holes - potentially, the most hazardous of all blasting situations. Avoid abrasion of cord on hole collars or casing pipes.

Incompatible materials: Strong oxidizing agents, The PVC/polyethylene plastic or wax covering will, in time, be affected by diesel oil.

Hazardous decomposition products: Carbon oxide. Nitrogen oxides (NOx). Hydrocarbons.

SECTION 11 – TOXICOLOGICAL INFORMATION

Acute Toxicity

Product Information: Irritating to eyes. May cause skin irritation. Harmful if swallowed.

Chronic Toxicity: Not available.

Carcinogenicity: The ingredients of this product are not classified as carcinogenic by ACGIH (American Conference of Governmental Industrial Hygienists) or IARC (International Agency for Research on Cancer), not regulated as carcinogens by OSHA (Occupational Safety and Health Administration), and not listed as carcinogens by T\NTP (National Toxicology Program).

Mutagenic effects: There is no evidence of mutagenic potential.

Irritation: Irritating to eyes. May cause irritation of respiratory tract. May cause skin irritation in susceptible persons.

Reproductive effects: No information is available and no adverse reproductive effects are anticipated.

Developmental effects: No information is available and no adverse developmental effects are anticipated.

Target Organ: Eyes, skin, respiratory system, blood, liver, urinary tract, gastrointestinal tract (GI), endocrine system, & immune system.

SECTION 12 – ECOLOGICAL INFORMATION

Ecotoxicity effects: There is no known ecological information for this product.

Persistence/Degradability: Not applicable.

Mobility in Environmental media: Not applicable.

SECTION 13 – DISPOSAL CONSIDERATIONS

Waste Disposal Method: Burn under supervision of an expert at an explosive burning ground or destroy by detonation in boreholes, in accordance with applicable local, provincial and federal regulations. Call upon the services of an Orica Technical Representative.

SECTION 14 – TRANSPORT INFORMATION

DOT Proper Shipping Name:	Cord, Detonating
Hazard Class:	1.1D
UN-No:	UN0065
Packing group:	II
TDG Proper Shipping Name:	Cord, Detonating
Hazard Class:	1.1D
UN-No:	UN0065
Packing group:	II

SECTION 15 – REGULATORY INFORMATION

CANADIAN CLASSIFICATION: This product has been classified in accordance with the hazard criteria of the CPR (Controlled Products Regulations) and this MSDS contains all the information required by the CPR

WHMIS hazard class: This product is an explosive and is not regulated by WHMIS.

USA CLASSIFICATION:

SARA Regulations Sections 313 and 40 CFR 372: This product contains the following toxic chemical(s) subject to reporting requirements,

SARA 311/312 Hazardous Categorization

Acute Heath Hazard:	No
Chronic Health Hazard:	No
Fire Hazard:	No
Reactive Hazard:	Yes
Sudden Release of Pressure Hazard:	No

Ozone Protection and 40 CFR 42: No reportable quantities of ozone depleting agents

Other Regulations/Legislations which apply to this product: No information available.

TSCA: Complies **DSL:** Complies **NDSL:** Complies

SECTION 16 – OTHER INFORMATION

Prepared by: **Safety Health & Environment**
303-268-5000

Preparation Date: 21-May-2005
Revision Date: 23-Jun-2009

REFERENCES:

RTECS-Registry of Toxic Effects of Chemical Substances, CCINFOdisc, Canadian Centre for Occupational Health and Safety, National Institute for Occupational Safety and Health, U.S. Dept. of Health & Human Services, Cincinnati, 1998.

Clayton, G.D. and Clayton, F.E., Eds., Patty's Industrial Hygiene and Toxicology, 3rd ed., Vol. IIA, B, C, John Wiley and Sons, New York, 1981.

Supplier's Material Safety Data Sheets.

CHEMINFO, HSDB, & NIOSH through "CCINFOdisc", Canadian Centre for Occupational Health and Safety, Hamilton, Ontario, Canada, 1998.

"CHEMINFO", "CHRIS", "TOG", "DOT", through "CCINFOdisc", Occupational Health and Safety, Hamilton, Ontario, Canada.

Documentation of the Threshold Limit Values and Biological Exposure Indices, 5th ed., American Conference of Governmental Industrial Hygienists Inc., Cincinnati, 1986.

Threshold Limit Values and Biological Exposure Indices for 1997, American Conference of Governmental Industrial Hygienists, Cincinnati, 1997.

Windholz, Martha, Ed., The Merck Index, 11 th ed., Merck and Co., Inc., Rahway, New Jersey, 1989

End of MSDS

Material Safety Data Sheet

Preparation Date: 18-Feb-2008 **Revision Date:** 13-Mar-2009 **Revision Number:** 1

SECTION 1 – PRODUCT AND COMPANY IDENTIFICATION

Supplier(s):

Orica Canada Inc.
Maple Street
Brownsburg, QC
For MSDS Requests: 1-450-533-4201

Orica USA Inc.
33101 E. Quincy Avenue
Watkins, CO 80137-9406
For MSDS Requests: 1-303-268-5000

Product Name:	**Ammonium Nitrate Prill**
Product Code:	40002
Alternate Name(s):	AN Prill
UN-No:	UN1942
Recommended Use:	Manufacture of Explosives. Manufacture of Blasting Agents.

Emergency Telephone Number: FOR CHEMICAL EMERGENCIES (24 HOUR) INVOLVING TRANSPORTATION, SPILL, LEAK, RELEASE, FIRE OR ACCIDENTS: **IN CANADA CALL:** THE ORICA TRANSPORTATION EMERGENCY RESPONSE SYSTEM AT **1-877-561-3636. IN THE U.S. CALL: CHEMTREC 1-800-424-9300. IN THE U.S.:** FOR LOST, STOLEN, OR MISPLACED EXPLOSIVES CALL: BATF **1-800-800-3855.** FORM ATF F 5400.0 MUST BE COMPLETED AND LOCAL AUTHORITIES (STATE/MUNICIPAL POLICE, ETC.) MUST BE ADVISED.

SECTION 2 – HAZARD IDENTIFICATION

Emergency Overview:
Irritating to eyes, respiratory system and skin. May cause methemoglobinemia.

Appearance:	**Physical State:**	**Odor:**
Grey or white prills	Prills	Odorless

SECTION 3 – COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Name	**CAS-No**	**Weight %**
Ammonium Nitrate	6484-52-2	98-100

SECTION 4 – FIRST AID MEASURES

General Advice:	In case of accident or if you feel unwell, seek medical advice IMMEDIATELY (show the product label where possible)
Eye Contact:	Immediately flush with plenty of water. After initial flushing, remove any contact lenses and continue flushing for at least 15 minutes. Immediate medical attention is required.
Skin Contact:	Wash off immediately with soap and plenty of water, removing all contaminated clothes and shoes. If skin irritation persists, call a physician.
Inhalation:	Move victim to fresh air. Give artificial respiration ONLY if breathing has stopped. Give cardiopulmonary resuscitation (CPR) if there is no breathing AND no pulse. Obtain medical advice IMMEDIATELY.
Ingestion:	Immediate medical attention is required. If victim is alert and not convulsing, rinse mouth out and give 200-300 mL (1 cup) of water to dilute material. Do no induce vomiting. Clean mouth with water and afterwards drink plenty of water. If spontaneous vomiting occurs, have victim lean forward with head positioned to avoid breathing in of vomitus, rinse mouth and administer more water. Never give anything by mouth to and unconscious person.

Notes to physician: Symptomatic. Administer oxygen if there are signs of cyanosis. If clinical condition deteriorates, administer 10cc Methylene Blue intravenously. It is unlikely for this to be required with methemoglobin level of less than 40%.

SECTION 5 – FIRE-FIGHTING MEASURES

Flammable properties: Not itself combustible by assists fire in burning materials. The product does not flash. Rate of burning: attempts to smother a fire involving this product will be ineffective as it is its own oxygen source.

Suitable extinguishing media: Use Water only, in as much volume as possible to cool the burning mass quickly. Chemical extinguishers will not work. Fire-fighters should wear positive pressure self-containing breathing apparatus (SCBA) and full turnout gear. Water may be applied through fixed extinguishing system (sprinklers) as long as people need not be present for the system to operate.

Unsuitable extinguishing media: Chemical extinguishers will not work. Attempts to smother a fire involving this product will be ineffective as it is its own oxygen source. Smother this product could lead to decomposition and explosion. This product is more sensitive to detonation if contaminated with organic or oxidisable material or if heated while confined. Unless the mass of product on fire is flooded with water, re-ignition is possible.

Specific hazards arising from the chemical: Toxic gases and vapours will be released by the thermal decomposition of this material. At higher temperatures, decomposition may be explosive, especially if confined. Immediately evacuate all personnel from the area to a safe distance. Guard against re-entry.

Protective equipment and precautions for firefighters: As in any fire, wear self-contained breathing apparatus pressure-demand, NIOSH approved (or equivalent) and full protective gear.

SECTION 6 – ACCIDENTAL RELEASE MEASURES

Methods for containment: Avoid dust formation. Do not breathe dust. Prevent further leak if safe to do so.

Methods for cleaning up: Avoid the use of metal tools containing iron and/or copper. Collect product in suitable containers for recovery or disposal. Prevent product from entering drains. Notify applicable government authority if release is reportable or could adversely affect the environment.

SECTION 7 – HANDLING AND STORAGE

Handling: Avoid contact with eyes or skin. Wash thoroughly with soap and water after handling. Wash clothing before re-use. Locate safety shoer and eyewash station closest to chemical handling area. The use of coveralls is recommended. Use good industrial hygiene and housekeeping practices. Keep away from open flames, hot surfaces and sources of ignition

Storage: Store in a cool, well-ventilated area. Keep away from heat, sparks, and flames. Keep storage containers closed. Store at 10-27°C (50-80°F). Do not expose closed containers to temperatures above 40°C (104°F). Product is mildly corrosive to concrete and steel. Stainless steel and aluminium are adequate. Avoid materials made of copper, iron, or bronze.

SECTION 8 – EXPOSURE CONTROLS/PERSONAL PROTECTION

Other exposure guidelines: Ammonium Nitrate: ORICA Guideline 5 mg/m^3 (internal TWA)

Engineering Measures: Where reasonably practicable this should be achieved by the use of local exhaust ventilation and good general extraction.

Personal Protective Equipment

Eye/Face Protection: Tightly fitting safety goggles.

Skin Protection: Gloves and protective clothing made from cotton should be impervious under normal conditions

Respiratory Protection: In case of insufficient ventilation wear suitable respiratory equipment. A NIOSH-approved respirator, if concentrations in air are unknown or in excess of established exposure guidelines

Hygiene Measures: Handle in accordance with good industrial hygiene and safety practice. Recommendations listed in this section indicate the type of equipment, which will provide protection against over exposure to this product. Conditions of use, adequacy of engineering or other control measures, and actual exposures will dictate the need for specific protective devices at your workplace.

SECTION 9 – PHYSICAL AND CHEMICAL PROPERTIES

Chemical Name:	Nitric Acid Ammonium Salt	**Chemical Family:**	Nitrates
Appearance:	Grey or white prills	**Odor:**	Odorless
Physical State:	Solid prills	**Viscosity:**	No information available
pH:	5 – 6 (0.1M solution in water)	**Flash Point:**	Not applicable
Autoignition Temperature:	Not applicable	**Boiling Point/Range:**	210°C/ 410°F
Melting Point/Range:	160–165°C/ 320-329°F	**Flammable Limits (Upper):**	Not applicable
Flammable Limits (Lower):	Not applicable	**Explosion Power:**	No data available
Specific Gravity:	1.72 g/cc	**Water Solubility:**	79% @25
Other Solubility:	Soluble in Alkalies, alcohols, acetone. Insoluble in ether.	**Vapor Pressure:**	0 mm Hg @20°C
Oxidizing Properties:	Oxidizer	**Partition Coefficient (n-octanol/water):**	No data available

SECTION 10 – STABILITY AND REACTIVITY

Stability: Stable under normal conditions. Decomposition Temperature: Ammonium Nitrate will spontaneously decompose at 210°C.

Conditions to avoid: Keep away from open flames, hot surfaces and sources of ignition. Not expected to be sensitive to static discharge. Not expected to be sensitive to mechanical impact. Keep away from light.

Incompatible materials: Avoid oxidizable materials, metal powder, bronze & copper alloys, fuels (e.g. lubricants, machine oils), fluorocarbon lubricants, acids, corrosive liquids, chlorate, sulphur, sodium nitrite, charcoal, coke and other finely divided combustibles, strong oxidizing and reducing agents. Keep away from combustible material.

Hazardous decomposition products: The following toxic decomposition products may be released. At temperatures above 210°C, decomposition may be explosive, especially if confined. Nitrogen oxides (NOx). Carbon oxide. Hydrocarbons. At higher temperatures, decomposition may be explosive, especially if confined.

Hazardous Polymerization: None under normal processing. Hazardous polymerization does not occur. Explosive material under shock conditions.

SECTION 11 – TOXICOLOGICAL INFORMATION

Acute Toxicity

Product Information: Irritating to eyes. May cause skin irritation. Harmful if swallowed. May cause methemoglobinemia.

Chemical name	LD50 Oral	LD50 Dermal	LC50 Inhalation
Ammonium Nitrate	2217 mg/kg Rat	3000 mg/kg Rabbit	88.8 mg/L Rat 4 h

Subchronic Toxicity (28 Days): Ammonium Nitrate: Ingestion may cause methemoglobinemia. Initial manifestation of methemoglobinemia is cyanosis, characterized by navy lips, tongue and mucous membranes, with skin color being slate grey. Further manifestation is characterized by headache, weakness, dyspnea, dizziness, stupor, respiratory distress and death due to anoxia. If ingested, nitrates may be reduced to nitrites by bacteria in the digestive tract. Signs and symptoms of nitrite poisoning include methemoglobinemia, nausea, dizziness, increased heart rate, hypotension, fainting and, possibly shock.

Chronic Toxicity: May cause methemoglobinemia.

Carcinogenicity: The ingredients of this product are not classified as carcinogenic by ACGIH (American Conference of Governmental Industrial Hygienists) or IARC (International Agency for Research on Cancer), not regulated as carcinogens by OSHA (Occupational Safety and Health Administration), and not listed as carcinogens by T\NTP (National Toxicology Program).

Mutagenic effects: There is no evidence of mutagenic potential.

Irritation: Irritating to eyes. May cause irritation of respiratory tract. May cause skin irritation in susceptible persons.

Reproductive effects: No information is available and no adverse reproductive effects are anticipated.
Developmental effects: No information is available and no adverse developmental effects are anticipated.
Target Organ: Eyes, skin, respiratory system, blood, liver, urinary tract, gastrointestinal tract (GI), endocrine system, & immune system.

SECTION 12 – ECOLOGICAL INFORMATION

Ecotoxicity effects: Dissolves slowly in water. Harmful to aquatic life at low concentrations.
Environmental Effects: Can be dangerous if allowed to enter drinking water intakes. Do not contaminate domestic or irrigation water supplies, lakes, streams, ponds, or rivers.

Persistence/Degradability: No data available.

Mobility in Environmental media: Dissolves slowly in water

SECTION 13 – DISPOSAL CONSIDERATIONS

Waste Disposal Method: Dispose of in accordance with National, State and local regulations. Should not be released into the environment. Do not dispose of waste with normal garbage, or to sewer systems. Call upon the services of an Orica Technical Representative.

SECTION 14 – TRANSPORT INFORMATION

DOT Proper Shipping Name: Ammonium Nitrate
Hazard Class: 5.1
UN-No: UN1942
Packing group: II
TDG Proper Shipping Name: Ammonium Nitrate
Hazard Class: 5.1
UN-No: UN1942
Packing group: II

Transportation Emergency Telephone Number: 1-877-561-3636 or CHEMTREC: 1-800-424-9300

SECTION 15 – REGULATORY INFORMATION

CANADIAN CLASSIFICATION: This product has been classified in accordance with the hazard criteria of the CPR (Controlled Products Regulations) and this MSDS contains all the information required by the CPR

WHMIS hazard class: C: Oxidizer. D-2B. Toxic.
USA CLASSIFICATION:
SARA Regulations Sections 313 and 40 CFR 372: This product contains the following toxic chemical(s) subject to reporting requirements, Ammonium Nitrate (6484-52-2).
SARA 311/312 Hazardous Categorization
Acute Heath Hazard: Yes
Chronic Health Hazard: ~~Yes~~ No
Fire Hazard: Yes
Reactive Hazard: No
Sudden Release of Pressure Hazard: No
Ozone Protection and 40 CFR 42: No reportable quantities of ozone depleting agents
Other Regulations/Legislations which apply to this product: New Jersey Right-to-Know, Pennsylvania Right-to-Know, Massachusetts Right-to-Know, Rhode Island Right-to-Know, Florida, New Jersey Special Health Hazard Substance List, Minnesota Hazardous Substance List, California Director's List of Hazardous Substances, California Proposition 65.

TSCA: Complies **DSL:** Complies **NDSL:** Complies

The components in the product are on the following international inventory lists:

Chemical Name	TSCA	DSL	NDSL	ENCS	EINECS	ELINCS	CHINA	KECL	PICCS	AICS
Ammonium Nitrate	X	X	-	X	X	-	X	X	X	X

Legend: X – Listed

SECTION 16 – OTHER INFORMATION

Prepared by: **Safety Health & Environment**
303-268-5000

Preparation Date: 14-May-2004
Revision Date: 13-March-2009

The information contained herein is offered only as guide to the handling of this specific material and has been prepared in good faith by technically knowledgeable personnel. It is not intended to be all-inclusive and the manner and conditions of use and handling may involve other and additional considerations. No warranty of any kind is given or implied and Orica will not be liable for any damages, losses, injuries or consequential damages which may result from the use of or reliance on any information contained herein.

End of MSDS

Technical Data Sheet

The Power of Partnership

Ammonium Nitrate

Description
Low density Industrial Grade Prills.

Application
Prilled Ammonium Nitrate (NH4NO3) is the primary oxidizer used in the production of ammonium nitrate fuel oil mixtures (ANFO); the most cost-effective bulk explosive for dry, surface and underground blasting applications.

Key Benefits
- Manufacture of Ammonium Nitrate / Fuel Oil blends, bulk emulsion blends, packaged emulsion products, packaged slurry products, and NCN explosives.
- Ammonium Nitrate is transported as an oxidizer.

Technical Properties

Ammonium Nitrate	
Bulk Density (g / cc)	0.74 – 0.87
Oil Absorption (wt%)	> 5.7
Size Distribution (wt%)	Tyler 6 – 20 (3.3 – 0.83 mm) > 95%
Total Nitrogen (wt%)	> 34
Moisture[1]	< 0.25
Coating (wt%)	0.04 - 0.15 organic
PH (10% solution)	4.5 – 6.0

Packaging
Bagged Production: Available in 25 kg (55 lb) two-ply polyethylene valve bags, or 25 kg (55 lb) polypropylene bags.

FIBC Production: Available in 400 kg (882 lb) to 1000 kg (2205 lb) capacities.

Bulk: Available in road truck, or rail car quantities (volumes per DOT restrictions).

Product Classification USA

Authorized Name:	*Ammonium nitrate*
Proper Shipping Name:	Ammonium nitrate
Classification:	5.1
UN No:	1942
Packaging Group :	III

Product Classification Canada

Authorized Name:	*Ammonium Nitrate*
Proper Shipping Name:	*Ammonium Nitrate*
Classification:	5.1
UN No:	1942
Packaging Group :	III

Storage and Handling
Storage

Due to its hygroscopic nature, it is important that the product be stored in dry silos or storage sheds, and not in humid or wet conditions. The internal crystalline structure of the product transitions at 32° C (90° F) and -18° C (0° F). In conjunction with these changes there are corresponding volume changes of 3.6% and 2.8% respectively. Repeated cycling through these temperatures can break down the structure of the product. This is most important during summer and winter months, where day/night temperature variations pass through either of these transition temperatures. If such exposure is unavoidable, expedient consumption is recommended.

If there is any concern an Orica Technical Representative should be contacted.

Disposal

Disposal of explosive materials can be hazardous. Methods of safe disposal of explosives may vary, depending on the user's situation. Please contact an Orica Technical Representative for information on safe practices.

Safety
Ammonium Nitrate poses the following hazards:
- Supports combustion
- Decomposes with excessive heating, releasing toxic fumes
- Potential for fire of explosion if heated during confinement
- Thermal and chemical burns
- Toxic to aquatic organisms
- See the MSDS for complete product details.

ORICA
www.oricaminingservices.com

Ammonium Nitrate

Trademarks

Disclaimer

The information contained herein is based on experience and is believed to be accurate and up to date as at the date of its preparation. However, uses and conditions of use are not within the manufacturer's control and users should determine the suitability of such products and methods of use for their purposes. Neither the manufacturer nor the seller makes any warranty of any kind, express or implied, statutory or otherwise, except that the products described herein shall conform to the manufacturer's or seller's specifications. The manufacturer and the seller expressly disclaim all other warranties, INCLUDING, WITHOUT LIMITATION, WARRANTIES CONCERNING MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. Under no circumstances shall the manufacturer or the seller be liable for indirect, special, consequential, or incidental damages without limitation, damages for lost or anticipated profits. Explosives based on Ammonium Nitrate may react with pyritic materials in the ground and create potentially hazardous situations. Orica accepts no responsibility for any loss or liability arising from use of the product in ground containing pyritic or other reactive material.

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Orica USA Inc.
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Tel: +1 303 268 5000
Fax: +1 303 268 5250

Emergency Contact Telephone Numbers

For chemical emergencies (24 hour) involving transportation, spill, leak, release, fire or accidents:

Canada: Orica Canada emergency response **1-877-561-3636**

USA: Chemtrec **1-800- 424-9300**

For lost, stolen or misplaced explosives:

USA: BATFE **1-800-800-3855**. Form ATF F5400.0 must be completed and local authorities (state / municipal police, etc) must be advised.

Notes

1. Ammonium Nitrate is hygroscopic. Any contact with moisture or humid air can weaken and break down the prill's internal crystalline structure.

Technical Data Sheet

The Power of Partnership

Centra™ Control System

Description

The *Centra™ Control* bulk emulsion system is a range of high-energy products, which provide superior performance under wet or dry conditions. *Centra™ Control* is available in a range of densities depending on product blend.

Application

Centra™ Control Bulk System is specifically designed for small diameter quarry and construction blasting applications in both wet and dry conditions.

Key Benefits

- *Centra™ Control* is manufactured and delivered with precise control at a rate to enhance your productivity compared to traditional quarry blasting.
- *Centra™ Control* is a solid sensitized product available in a range of blends and densities for improved vibration control, increased shock energy for fragmentation, or increased heave energy for cast performance.
- Stemming operations can occur immediately after loading *Centra™ Control*, increasing on bench productivity.
- The increased energy of Centra™ Control enables pattern expansion resulting in reduced drilling and quarrying costs.
- *Centra™ Control* is an energetic explosive with proven reliability in the most difficult blasting applications.
- The high on bench productivity of *Centra™ Control* means faster delivery and turnaround of shots.
- *Centra™ Control* provides fully coupled explosive charges to maximize blasting outcomes.
- OH&S issues around the handling and storage of packaged products is eliminated.

Technical Properties

***Centra™ Control* System**								
Property		**25**	**30**	**40**	**50**	**70**	**80**	**100**
Density (g/cc) [1]		1.17	1.23	1.3	1.32	1.28	1.26	1.25
Minimum Blasthole Diameter	in.	5	5	5	5	4	3.5	3
	mm	127	127	127	127	101	89	90
Hole Type		Dry		Dewatered		Wet or Dry		
Delivery System		Augered				Pumped		
Recommended Pentex Primer for minimum hole diameter [2]		16 oz. Pentex Primer						
Typical VOD [3]	m/s (1,000's)	4.0	4.0	4.1	4.9	5.2	5.3	5.5
	ft/s (1,000's)	13.0	13.0	13.5	16	17	17.5	18
Relative Effective Energy (REE) [4]	RWS	114	117	119	118	110	106	100
	RBS	159	171	184	185	168	159	150
Sleep time		1 month						

Recommendations for Use

Blasthole Charge Length

Centra™ Control is suitable for use in holes of up to 25 m (82 ft) in length, depending on hole diameter, product density and presence of water. Please contact an Orica Technical Representative for further information.

Priming and Initiation

Centra™ Control must be initiated using a *Pentex™* primer appropriate for the blasthole size in conjunction with an *Exel™* detonator. Use of detonating cord with *Centra™ Control* is not recommended.

Charging

Centra™ Control is delivered by an Orica Mobile Manufacturing Units (*MMU™*). *Centra™ Control* is manufactured on the *MMU™* and delivered into blastholes on demand.

Ground Temperature

These products are available for use in ground temperatures 0°C (32ºF) to a maximum of 55°C (131ºF). If your application requires you to operate outside this temperature range, please contact your local Orica Technical Representative.

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Centra™ Control System

Sleep Time Within Blastholes

The recommended maximum sleep time is 1 month. Sleep time is dependent on factors such as hole diameter, density, ground water conditions, and initiation system. An Orica Technical Representative should be consulted if special conditions exist.

Storage and Handling

Product Classification

Authorized Name:	*Centra™ Control 25*
	Centra™ Control 30
	Centra™ Control 40
	Centra™ Control 50
	Centra™ Control 70
	Centra™ Control 80
	Centra™ Control 100
Proper Shipping Name:	Explosive, blasting, type E
Classification:	1.5D
UN Number:	0332 PG II
EX Number:	
1986020034 (Charlestown)	*Centra™ Control 70*
	Centra™ Control 80
1998100075 (Charlestown)	*Centra™ Control 100*

Disposal

Disposal of explosive materials can be hazardous. Methods of safe disposal of explosives may vary depending on the user's situation. Please contact a local Orica Technical Representative for information on safe practices.

Safety

Centra™ Control is relatively insensitive to accidental initiation by shock, friction or mechanical impact under normal conditions of use. Detonation may occur from heavy impact or excessive heating, particularly under conditions of confinement.

Explosives based on Ammonium Nitrate such as the *Centra™ Control* may react with pyritic materials in the ground and create potentially hazardous situations. Orica accepts no responsibility for any loss or liability arising from use of the product in ground containing pyritic or other reactive material.

Trademarks

Disclaimer

Warning: *Carbon monoxide and carbon dioxide may migrate through the ground after detonation of explosives. Consult an Orica Technical Representative for specific applications.*

Centra™ Control System

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Emergency Contact Telephone Numbers

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USA: Chemtrec **1-800- 424-9300**

For lost, stolen or misplaced explosives:
USA: BATFE **1-800-800-3855**. Form ATF F5400.0 must be completed and local authorities (state/municipal police, etc) must be advised.

Notes

1. Nominal density only.
2. Where ground movement is likely or charge lengths are in excess of 10 meters Orica recommends extra insurance priming.
3. VOD will depend on application including explosive density, blasthole diameter, and degree of confinement. The VOD range is based on minimum unconfined and calculated ideal.
4. The “Relative Effective Energy” (REE) of an explosive is the energy calculated to be available to do effective blasting work. All energy values are calculated using the *IDeX*™ computer code owned by Orica for the exclusive use of its companies. Energy values are based on standard ANFO with a density of 0.84 g/cc and a cut-off pressure of 100Mpa. Other computer codes may give different values.

Technical Data Sheet

Centra™ Gold System

The Power of Partnership

Description

The *Centra™ Gold* Bulk System is a range of high energy, water resistant pumped emulsion blends. *Centra™ Gold* is a chemically sensitized, variable density product.

Application

Centra™ Gold is specifically designed for small diameter quarry and construction blasting applications in both wet and dry conditions. The *Centra™ Gold* Bulk System is not suitable for blasting in ground containing reactive sulphide.

Key Benefits

- *Centra™ Gold* is manufactured and delivered with precise control at a rate to enhance your productivity compared to traditional quarry blasting.
- *Centra™ Gold* is an energetic explosive with proven reliability in the most difficult blasting applications.
- The increased energy of *Centra™ Gold* enables pattern expansion resulting in reduced drilling and quarrying costs.
- *Centra™ Gold* maximizes energy and promotes muckpile movement.
- *Centra™ Gold* provides fully coupled explosive charges to maximize blasting outcomes.
- The high on-bench productivity of the *Centra™ Gold* range means faster delivery and turnaround of shots.
- OH&S issues around the handling and storage of packaged products are eliminated.

Recommendations for Use

Blasthole Charge Length

Centra™ Gold is suitable for use in holes of up to 25 meters (82 ft.) in length, depending on hole diameter, product density and the presence of water. If exceeding an in-hole depth of 25 meters (82 ft.), please consult an Orica Technical Representative for application guidelines.

Technical Properties

***Centra™ Gold* System**			
Property		**70**	**100**
Density (g/cc) (1)		1.05-1.28	0.95-1.25
Minimum Blasthole Diameter	In.	3	2
	mm	75	50
Hole Type		Wet or Dry	
Delivery System		Pumped	
Recommended *Pentex™* Primer for minimum hole diameter (2)		See below	
Typical VOD (3)	m/s (1,000's)	5.2	5.5
	ft/s (1,000's)	17	18
Relative Effective Energy (REE) (4)	RWS	111	103
	RBS	169	151
Sleep time		1 month	

Priming and Initiation

Centra™ Gold is a booster sensitive emulsion and must be in direct contact with an appropriately sized *Pentex™* booster. The use of detonating cord may adversely affect the performance of the *Centra™ Gold* series and could result in misfires. Consult an Orica Technical Representative before attempting to use with detonating cord.

Charging

Centra™ Gold is delivered by Orica in Mobile Manufacturing Units (*MMU™*). *Centra™ Gold* is manufactured on the *MMU™* and pumped into blastholes on demand.

Sleep-Time Within Blastholes

The recommended maximum sleep time is 1 month. Sleep time is dependent on factors such as hole diameter, density, ground water conditions and initiation system. An Orica Technical Representative should be consulted if special conditions exist.

Centra™ Gold System

Ground Temperature

These products are available for use in ground temperatures 0°C (32°F) to a maximum of 55°C (131°F). If your application requires you to operate outside this temperature range, please contact your Orica Technical Representative.

Storage and Handling

Product Classification

Authorized Name:	*Centra™ Gold 70*
	Centra™ Gold 100
Proper Shipping Name:	Explosive, blasting, type E
Classification:	1.5D
UN Number:	0332

Disposal

Disposal of explosive materials can be hazardous. Methods of safe disposal of explosives may vary, depending on the user's situation. Please contact an Orica Technical Representative for information on safe practices.

Safety

Centra™ Gold is relatively insensitive to accidental initiation by shock, friction, or mechanical impact under normal conditions of use. Detonation may occur from heavy impact or excessive heating, particularly under conditions of confinement.

Explosives based on Ammonium Nitrate such as *Centra™ Gold* may react with pyritic materials in the ground and create potentially hazardous situations. Orica accepts no responsibility for any loss or liability arising from use of the product in ground containing pyritic or other reactive material.

Trademarks

Disclaimer

The information contained herein is based on experience and is believed to be accurate and up to date as at the date of its preparation. However, uses and conditions of use are not within the manufacturer's control and users should determine the suitability of such products and methods of use for their purposes. Neither the manufacturer nor the seller makes any warranty of any kind, express or implied, statutory or otherwise, except that the products described herein shall conform to the manufacturer's or seller's specifications. The manufacturer and the seller expressly disclaim all other warranties, INCLUDING, WITHOUT LIMITATION, WARRANTIES CONCERNING MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. Under no circumstances shall the manufacturer or the seller be liable for indirect, special, consequential, or incidental damages without limitation, damages for lost or anticipated profits.

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Emergency Contact Telephone Numbers

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USA: Chemtrec **1-800- 424-9300**

For lost, stolen or misplaced explosives:
USA: BATFE **1-800-800-3855**. Form ATF F5400.0 must be completed and local authorities (state / municipal police, etc) must be advised.

Centra™ Gold System

Notes

1. Nominal density only.
2. Where ground movement is likely or charge lengths are in excess of 10 meters Orica recommends extra insurance priming.
3. The actual VOD depends on the conditions of use including the diameter of the hole and the degree of confinement. VOD's can be higher in holes greater than 102 mm.
4. The "Relative Effective Energy" (REE) of an explosive is the energy calculated to be available to do effective blasting work. All energy values are calculated using the *IDeX*™ computer code owned by Orica for the exclusive use of its companies. Energy values are based on standard ANFO with a density of 0.84 g/cc and a cut-off pressure of 100Mpa. Other computer codes may give different values.

Technical Data Sheet

Exel™ Connectadet™

Non-Electric, Short Delay Trunkline Assembly

The Power of Partnership

Description

Exel™Connectadet™ non-electric, short delay, trunk line assemblies provide out-of-hole delays in non-electric blast patterns. Used in conjunction with *Handidet™* or *Exel™ MS* in-hole shock tube detonator assemblies, *Exel™ Connectadet™* assemblies provide flexibility in blast design and ease of use. They can be used in quarries, surface coal operations, open pit and underground mines and construction projects to provide accurate surface timing.

Benefits

- Eliminates the need for detonating cord trunk lines
- Does not require burying - lower shrapnel damage potential
- Provides excellent, flexible blast control
- Allows easy connection, even with gloves
- Allows pre-blast changes to blast design
- Allows quick and easy hookup verification
- Does not tangle - no waste

Features

- Rugged, with abrasion resistant tubing
- New lower energy design
- Accurately timed in eight delays
- Quick and simple to connect; highly visible **6 tube** ergonomic connector design
- In easy-to-handle figure-eight coils

Properties

Connector Block	Color coded by surface delay time
Exel™ Shock Tube	Green with color coded flag tag indicating delay time and length

Delay Times	
Milliseconds	Connector block color
9	Green
17	Yellow
25	Red
33	Orange
42	White
65	Dark Blue
100	Black
200	Orange

Handling and Initiation

Avoid damage to the shock tube. Never pull so hard as to stretch or break shock tubing. A premature detonation may result. *Exel™ Connectadet™* assemblies are unidirectional. They can be initiated with:

- Another Orica shock tube surface delay system
- An electric detonator
- An Orica electronic detonator

The *Exel™ Connectadet™* assembly is not designed to initiate detonating cord. Misfires can result.

***Note**: The connector block of the Exel™ Connectadet™ assembly contains an explosive device that can be initiated by heat, impact or friction.*

Exel™ Connectadet™

Non-Electric, Short Delay Trunkline Assembly

Packaging

Exel™ Connectadet™ assemblies are wound in figure-eight coils and packed in bundles of five in fiberboard cases.

Other lengths may be available by special arrangement. Some length/delay combinations may not be available.

Length		Quantity Per Case
Meters	Feet	
4	12	100
6	20	80
9	30	65
12	40	50
15	50	45
18	60	40

Storage

For best results, store under moderate temperatures and dry conditions in a well ventilated, approved detonator magazine.

Hazardous Materials Shipping Description

Detonator Assemblies, Non-electric,
Class and Division 1.4S
UN 0500, PG II

Trademarks

Disclaimer

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Emergency Contact Telephone Numbers

For chemical emergencies (24 hour) involving transportation, spill, leak, release, fire or accidents:
Canada: Orica Canada emergency response **1-877-561-3636**
USA: Chemtrec **1-800- 424-9300**

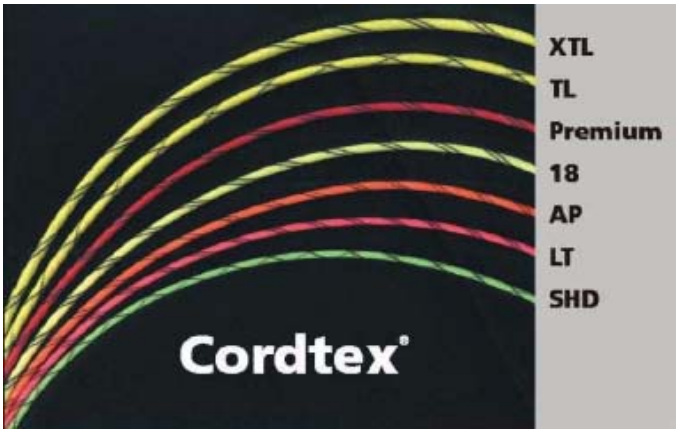
For lost, stolen or misplaced explosives:
USA: BATFE **1-800-800-3855**. Form ATF F5400.0 must be completed and local authorities (state / municipal police, etc) must be advised.

Technical Data Sheet

Cordtex®

Detonating Cords

The Power of Partnership



Description

Cordtex® detonating cords provide non-electric initiation of blast patterns for both surface and underground blasting. Used either in conjunction with Orica non-electric assemblies in-hole or as a downline to initiate *Exel® SHD* assemblies, there is a *Cordtex®* detonating cord that will satisfy most blasting requirements.

Benefits

Cordtex® detonating cords:

- Hold their knots in both hot and cold temperature conditions
- Stand up to tough conditions
- Withstand tough borehole conditions
- Facilitate rapid identification
- Allow long in-hole sleep times
- Match energies to applications

Features

Cordtex® detonating cords are:

- Easy to connect via knotting
- Rugged with an abrasion resistant finish
- Have high tensile strength
- Brightly colored wax and thread coding
- Highly resistant to side penetration of water
- and fuel oil
- Available in a variety of coreloads

Product Type	Nominal Coreload		Nominal Diameter		Breakload		Color	Identifying Thread Code	Packaging Spools per Case
	g/m	gr/ft	mm	In.	kg	Lbs.			
Cordtex® SHD	2.0	9.5	3.3	0.130	90	198	Green	2 Crossed Black	Two 600 m/1968 ft
Cordtex® LT	3.2	15	3.7	0.146	75	165	Pink	2 Parallel Black	Two 500 m/1640 ft
Cordtex® AP	4.3	20	3.9	0.155	100	220	Orange	2 Parallel Black	Four 300 m/984 ft
Cordtex® 18	5.3	25	4.1	0.160	100	220	Lime-Green	2 Parallel Black	Four 300 m/984 ft
Cordtex® Premium	5.3	25	4.2	0.165	100	220	Red	2 Parallel Black	Four 300 m/984 ft
Cordtex® TL	7.5	35	4.7	0.185	109	240	Yellow	2 Crossed Black	Two 300 m/984 ft
Cordtex® XTL	10.2	48	5.1	0.200	129	284	Yellow	2 Parallel Black	Two 300 m/984 ft

Handling and Initiation

Cordtex® detonating cord may be cut using a sharp knife or anvil-type pruning shears.

Warning:

- *Cordtex® SHD* and *Cordtex® LT* are reduced coreload detonating cords and *should not be spliced (knotted)* together or used to initiate other detonating cords. Misfires may result.
- All *Cordtex®* detonating cords may be initiated by Cordtex® AP or higher coreload detonating cord or by a high strength detonator.
- Only *Cordtex® AP, Cordtex® 18* or *Cordtex® Premium* are reliable initiators of *Exel® SHD* detonator assemblies via the slider tunnel in slider booster orientations.

Packaging

Cordtex® detonating cord is spooled and packed in fiberboard cases.

Storage

For best results, store under moderate temperatures and dry conditions in a well ventilated, approved explosive magazine.

Hazardous Materials Shipping Description

Cordtex® is Cord, Detonating
Class and Division 1.1D, UN 0065, PG II

Disclaimer

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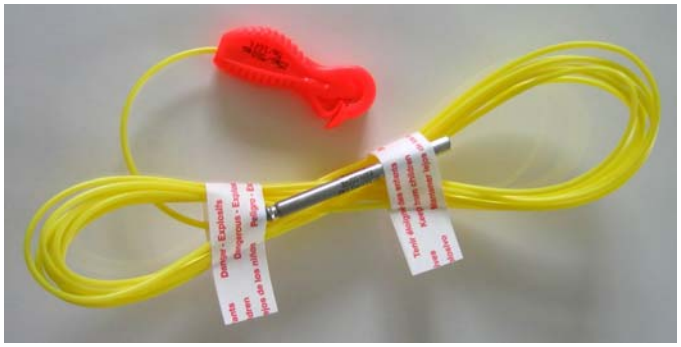
Technical Data Sheet

Exel™ Handidet™

Non-Electric, Surface Delay and In-hole Detonator Assembly

The Power of Partnership



Description

Exel™ *Handidet*™ non-electric, surface delay and in-hole detonator assemblies are easy-to-use components in non-electric sequential blasting applications. Used in pipeline and utility trenching, quarries, open pits and construction projects, *Exel*™ *Handidet*™ assemblies are easy to connect, easy to verify, and provide accurate surface and in-hole timing.

Benefits

- Reduces the number of components on site
- Allows pre-blast changes to pattern design
- Reduces inventory
- Provides excellent blast control
- Allows easy hookup - increase productivity
- Facilitates rapid hookup verification
- Reduces chance of ground movement cutoff failures
- Can be used in all weather conditions
- No tangles, no waste
- Reduces operating costs

Features

- Surface and in-hole delays in one unit
- New lower energy design
- Accurately timed
- Quick and simple to connect
- Highly visible **6 tube** ergonomic connector design
- Highly visible
- Rugged, with new abrasion resistant tubing
- Resistant to hot or cold conditions; easy to handle in figure-eight coils

Properties

In-hole Detonator	High Strength, 12 grain (780 mg) PETN base charge (USBM 8+)
Surface Delay Initiator	New Low Shrapnel
Connector Block	**6 tube** capacity, color coded by surface delay time, indelibly printed with length and delays
Exel™ Shock Tube	Bright yellow color

Delay Nominal Times	
Surface/In-hole (ms)	**Connector block color**
17/500	Yellow
25/475	Orange
# 25/500	Orange
42/475	White
42/500	White
42/700	White
# Standard short delay combination	

Other delays may be available by special arrangements.

Handling and Initiation

Do not use the *Exel*™ *Handidet*™ assembly as a lowering line. Keep the shock tube taut until loading has been completed. Avoid damage to the shock tube during loading and stemming operations.

Never pull so hard as to stretch or break shock tubing. A premature detonation may result.

Exel™ *Handidet*™ detonator assemblies are unidirectional. They can be initiated by:

- The surface initiator from another *Exel*™ *Handidet*™
- An Orica electronic detonator
- An electric detonator
- An Orica shock tube surface delay system

www.oricaminingservices.com

Exel™ Handidet™

Non-Electric, Surface Delay and In-hole Detonator Assembly

***Note**: The surface connector block of the Exel™ Handidet™ assembly contains an explosive device that can be initiated by heat, impact or friction. The surface connector is not designed to initiate detonating cord.*

Packaging

Exel™ Handidet™ detonator assemblies are wound in figure-eight coils. Assemblies are bulk packed in fiberboard cases.

Length (approx)		Quantity per Case	
Meters	**Feet**	**1.1B**	**1.4B**
4	12	100	90
5	16	100	90
7	23	75	70
8	26	75	70
9	30	65	60
12	40	50	50
15	50	45	45
18	60	40	30
25	80	25	25
30	100	25	25
37	120	20	20

Other lengths may be available by special arrangements. Some length/delay combinations may not be available.

Storage

For best results, store under moderate temperatures and dry conditions in a well ventilated, approved detonator magazine.

Hazardous Materials Shipping Description

Detonator Assemblies, Non-electric,
Class and Division 1.1B
UN 0360, PG II

Class and Division 1.4B
UN 0361, PGII

Trademarks

Disclaimer

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Emergency Contact Telephone Numbers

For chemical emergencies (24 hour) involving transportation, spill, leak, release, fire or accidents:
Canada: Orica Canada emergency response **1-877-561-3636**
USA: Chemtrec **1-800- 424-9300**

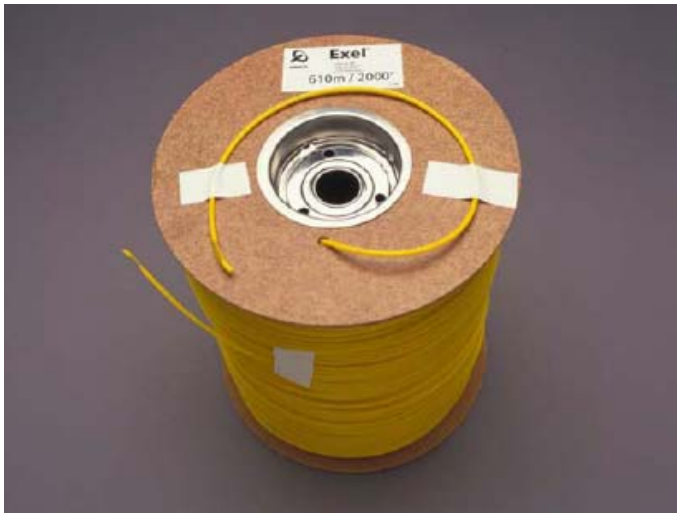
For lost, stolen or misplaced explosives:
USA: BATFE **1-800-800-3855**. Form ATF F5400.0 must be completed and local authorities (state / municipal police, etc) must be advised.

Technical Data Sheet

Exel™ Lead-in Line

Bulk Shock Tube

The Power of Partnership



Description

Exel™ *Lead-in Line* is a long length of shock tube. Used to extend the length of non-electric assemblies, *Exel*™ *Lead-in Line* allows non-electric blast initiation from a safe location. They can be used at surface or underground mines, at quarries or at construction projects.

Benefits

- Reduce electrical hazards at blast initiation time
- Reduce blasting noise
- Provide positive blast initiation control

Features

A cost effective replacement for electrical and detonating cord blast initiation systems when used with non electric assemblies
Highly visible
Easy to handle and deploy- don't tangle

Properties

Exel™ Shock Tube	Yellow 0.0118" / 3 mm dia.
Splicing sleeves	Clear plastic 1" / 25 mm long
End Caps	Red colored end closures protect tubing from debris

Handling and Initiation

Avoid damage to the shock tube. Never pull so hard as to stretch or break shock tubing. A premature detonation may result.

Exel™ *Lead-in Line* can be initiated with:

- A non-electric starter device
- A non-electric detonator assembly
- An electric detonator assembly

Exel™ *Lead-in Line* is designed to be spliced into non-electric assemblies.

- *Exel*™shock tube can be cut with a sharp knife or with anvil type pruning shears
- Cuts should be made clean and at right angles taking care not to crush or collapse the cut ends
- Place end caps on the cut ends on the spool to limit the exposure to moisture
- Push the spliced ends into the splicing sleeve so they butt together in the centre
- Do not place tubing splices under tension

Packaging

Exel™ *Lead-in Line* is spooled and packed in fiberboard cases containing two 610 meter / 2000 foot spools, 10 end caps and 10 splicing sleeves.

Storage

For best results, store under moderate temperatures and dry conditions in a well ventilated, approved explosives magazine.

Exel™ Lead-in Line

Bulk Shock Tube

Hazardous Materials Shipping Description

Exel™ Lead-in Line is Articles Explosive N.O.S.
(Shock Tube)
Class 1.4S, UN 0349, PG II

Trademarks

Disclaimer

Emergency Contact Telephone Numbers

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Technical Data Sheet

Exel™ MS

Non-Electric, Short Delay Detonator Assembly

The Power of Partnership

Description

Exel™ MS detonator assemblies provide short-delay, non-electric initiation of blast patterns. Used in conjunction with detonating cord trunk lines or other Orica non-electric surface delay systems, *Exel™ MS* assemblies, in 34 delay periods, provide flexibility in blast design and ease of use. They can be used at surface or underground mines, at quarries or at construction projects.

Benefits

- Reliably initiates all detonator-sensitive explosives; doesn't adversely affect the explosives column energy
- Stands up to tough conditions
- Provides excellent, flexible blast control
- Allows easy connection
- Facilitates rapid hookup verification
- Does not tangle - no waste

Features

- High strength shock tube detonator assemblies
- Rugged, with abrasion resistant tubing
- Accurately timed in 34 standard delay periods
- Quick and simple to connect
- Brightly colored components
- In easy handle figure-8 coils

Properties

Exel™ Shock Tube	Yellow with color-coded flag tag indicating length, delay number, and delay time.
Detonating Cord Clip	Fluorescent Orange Cobra™ Connector imprinted with the delay number
Detonator	High Strength, 12 grain (780mg) PETN base charge (USBM 8+).

Delay Numbers and Nominal Times			
Number	**Time (ms)**	**Number**	**Time (ms)**
0	0	17	425
1	25	18	450
2	50	19	475
3	75	20	500
4	100	22	550
5	125	24	600
6	150	26	650
7	175	28	700
8	200	32	800
9	225	36	900
10	250	40	1000
11	275	**48**	1200
12	300	**56**	1400
13	325	**64**	1600
14	350	**72**	1800
15	375	**80**	2000
16	400	**90**	2250

Delays in **Bold Font** available in select lengths only.

Handling and Initiation

Avoid damage to the shock tube. Do not use the shock tube as a lowering line.

Never pull so hard as to stretch or break shock tubing. A premature detonation may result.

Exel™ MS

Non-Electric, Short Delay Detonator Assembly

The Power of Partnership

Exel™ MS detonator assemblies can be initiated with:

- Another Orica shock tube surface delay system
- *Cordtex™ AP, Cordtex™ 18*, or higher strength detonating cords

Packaging

Exel™ MS assemblies are wound in figure-eight coils. Shorter lengths are packed in cartons (10 per case), longer lengths are bulk packed. They are shipped in fiberboard cases.

Length		Quantity per Case	
Meters	**Feet**	**1.1B**	**1.4B**
4	12	150	90
5	16	150	90
6	20	100	75
7	24	100	-
9	30	80	60
12	40	60	50
15	50	50	40
18	60	45	30
25	80	30	30
30	100	25	25
37	120	20	20
45	150	15	15
50	165	15	15

Some length and delay combinations may not be available.

Storage

For best results, store under moderate temperatures and dry conditions in a well ventilated, approved detonator magazine.

Hazardous Materials Shipping Description

Detonator Assemblies, Non-electric,
Class and Division 1.1B,
UN 0360, PG II

Class and Division 1.4B,
UN 0361, PGII

Trademarks

Disclaimer

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Emergency Contacts

For chemical emergencies (24 hour) involving transportation, spill, leak, release, fire or accidents:
Canada: Orica Canada emergency response **1-877-561-3636**
USA: Chemtrec **1-800- 424-9300**

For lost, stolen or misplaced explosives:
USA: BATFE **1-800-800-3855**. Form ATF F5400.0 must be completed and local authorities (state / municipal police, etc) must be advised.

Technical Data Sheet

The Power of Partnership

Pentex™ AP Cast Boosters

Description

Pentex™ AP Cast Boosters provide high energy initiating power for a wide range of explosive applications. The recessed groove in the base of *Pentex™ AP Cast Boosters* ensures reliable initiation with all types of detonator assemblies. They can be used to provide safe and reliable priming of booster sensitive explosives on most surface and underground blasting operations.

Pentex™ AP Cast Boosters are ideal for use in blasting applications which require multiple decking and multiple boosters down the hole.

Benefits

- High velocity
- High density
- High detonation pressure
- Unlimited shelf life under proper storage conditions
- Excellent water resistance
- High safety and reliability
- Concentrated detonation energy

Properties

Pentex™ AP Cast Boosters	12 * 340 (ounce * gram)	16 * 454 (ounce * gram)	32 * 908 (ounce * gram)
Diameter x Length	53 mm x 120mm	60 mm x 120mm	84 mm x 120mm
	2.106" x 4.724"	2.382" x 4.724"	3.299" x 4.724"
Density	1.6 g/cc		
Velocity of Detonation	7,924 m/s (26,000 ft/s)		
Detonation Pressure	250 kb		
Water	Excellent		
Tunnel Arrangement	One blind detonator well and two through tunnels		
Pentex™ AP	A cardboard cylindrical canister Pentolite cast booster with a cap well and two through tunnels for detonator assemblies and medium core-load detonating cords (*Cordtex™ 18*)**.** Available in sizes 12 ounce / 340 g, 16 ounce / 454 g and 32 ounce / 908 g. AP Booster		

Initiation and Handling

Pentex™ AP Cast Boosters can be initiated by standard high strength electric, electronic and non-electric detonators or by 18 grain/ft. (3.6 gram/m) detonating cord threaded into the center through tunnel.

When used with booster-sensitive explosives, ensure that the primer is in intimate contact with, and surrounded by, the explosive.

Packaging

Pentex™ AP Cast Boosters are packed in fiberboard cases.

Product	Quantity Per Case	Weight per case (lbs/kg)
Pentex™ AP 12* 340	42	36.3 / 16.5
Pentex™ AP 16* 454	35	38.5 / 17.5
Pentex™ AP 32* 908	18	38.9 / 17.7

Pentex™ AP Cast Boosters

Storage

Cast boosters are high explosives. For best results, store under moderate temperatures and dry conditions in a well ventilated, approved explosives magazine.

Shelf Life

If stored and handled properly, the **shelf life** of *Pentex™ AP Cast Boosters* is unlimited.

Hazardous Materials Shipping Description

Boosters, without detonator
Class and Division 1.1D,
UN 0042, PG II

Distributed to Orica by BST Manufacturing, Inc.
924 Hawaii Avenue, Minden, LA 71055 USA

Trademarks

Disclaimer

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Emergency Contact Telephone Numbers

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USA: Chemtrec **1-800- 424-9300**

For lost, stolen or misplaced explosives:
USA: BATFE **1-800-800-3855**. Form ATF F5400.0 must be completed and local authorities (state / municipal police, etc) must be advised.

Technical Data Sheet

The Power of Partnership

Pentex™ D Cast Boosters

Description

Pentex™ D Cast Boosters provide high energy initiating power for a wide range of explosive applications. The product is typically manufactured with de-mil high explosives and may contain a small percentage of aluminium. The recessed groove in the base of *Pentex™ D Cast Boosters* ensures reliable initiation with all types of detonator assemblies. They can be used to provide safe and reliable priming of booster sensitive explosives on most surface and underground blasting operations. They are idea for use in Detonator Only Blasting Applications.

Benefits

- High velocity
- High density
- High detonation pressure
- Unlimited shelf life under proper storage conditions
- Excellent water resistance
- High safety and reliability
- Concentrated detonation energy

Properties

Pentex™ D Cast Boosters	8 * 228 (oz / gm)	12 * 340 (oz / gm)	16 * 454 (oz / gm)	32 * 908 (oz / gm)
Diameter	40.6 mm	51.3 mm	57.6 mm	80.0 mm
	1.60”	2.02”	2.27”	3.15”
Length	125.7 mm	125.7 mm	125.7 mm	125.7 mm
	4.95”	4.95”	4.95”	4.95”
Density (g/cc)	1.61	1.62	1.62	1.62
VOD (m/s)	7500	7550	7600	7600
VOD (ft/s)	24,600	24,800	24,900	24,900
Detonation Pressure (Kb)	230	230	230	230
Water	Excellent			
Tunnel Arrangement	One blind detonator well and one through tunnel.			
Pentex™ D (detonator only)	A cardboard cylindrical canister cast booster with a cap well and through tunnel for detonator assemblies. Available in 8 ounce / 228 g, 12 ounce / 340 g, 16 ounce / 454 g and 32 ounce / 908 g sizes.`			

Initiation and Handling

Pentex™ D Cast Boosters can be initiated by standard high strength electric, electronic and non-electric detonators.

Note: Detonating cords are not to be used to initiate *Pentex™ D Cast Boosters*.

When used with booster-sensitive explosives, ensure that the primer is in intimate contact with, and surrounded by, the explosive.

Pentex™ D Cast Boosters

Packaging

Pentex™ D Cast Boosters are packed in fiberboard cases.

Product	Quantity Per Case	Weight per case (lbs/kg)
Pentex™ D 8 * 228	72	39.0 / 17.7
Pentex™ D 12* 340	42	36.3 / 16.5
Pentex™ D 16* 454	35	38.5 / 17.5
Pentex™ D 32* 908	18	38.9 / 17.7

Storage

Cast boosters are high explosives. For best results, store under moderate temperatures and dry conditions in a well ventilated, approved explosives magazine.

Shelf Life

If stored and handled properly, the **shelf life** of *Pentex™ D Cast Boosters* is unlimited.

Hazardous Materials Shipping Description

Boosters, without detonator
Class and Division 1.1D,
UN 0042, PG II

Distributed to Orica by BST Manufacturing, Inc.
924 Hawaii Avenue, Minden, LA 71055 USA

Trademarks

Disclaimer

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Technical Data Sheet

The Power of Partnership

Powercord™

Detonating Cords

Description

Powercord™ detonating cords provide high velocity energy for "pre" or "post" blasting in construction and dimension stone applications. Used in the hole as the explosive charge itself *Powercord*™ can be easily cut from its spooled packaging to fit specific site requirements.

Benefits

- Stand up to tough conditions
- Withstand tough borehole conditions
- Facilitate rapid loading
- Allow long in-hole sleep times
- Match energies to applications

–

Features

- Rugged with an abrasion resistant finish
- Have high tensile strength
- Thread coding for size identification
- Highly resistant to side penetration of water and fuel oil
- Available in a range of coreloads

Properties

Property	Powercord™ 100	Powercord™ 150	Powercord™ 200
Color	Clear	Clear with black tread	Clear
Outer Finish	Polyethylene	Polyethylene	Polyethylene
PETN Coreload			
(g/m)	21.3	31.9	42.6
(gr./ft)	100	150	200
Nominal Diameter			
(mm)	6.1	7.0	7.6
(in.)	0.240	0.275	0.300
Breakload			
(kg)	100	120	120
(lbs)	220	264	264
Length per Spool			
(m)	300	150	150
(ft)	984	492	492
Spools per Case	1	1	1

Powercord™ *200* is available in orange plastic
Special ordered as *Powercord*™ *O 200*

Handling and Initiation

Powercord™ detonating cord may be cut using a sharp knife or anvil-type pruning shears.

All *Powercord*™ detonating cords may be initiated by *Trunkline*™ or *Cordtex*™ *XTL* knotted to the *Powercord*™ outside the borehole or by a high strength detonator securely taped to the cord.

Packaging

Powercord™ detonating cord is spooled and packed in fiberboard cases.

Powercord™
Detonating Cords

Storage
For best results, store under moderate temperatures and dry conditions in a well ventilated, approved explosive magazine.

Hazardous Materials Shipping Description
Powercord™ is Cord, Detonating,
Class and Division 1.1D,
UN 0065, PG ll

Trademarks
The word Orica, the Ring device and the Orica mark are trademarks of Orica Group Companies. *Powercord*™, *Cordtex*™, and *Trunkline*™ are trademarks of Orica Explosives Technology Pty Ltd. ACN 075 659 353, 1 Nicholson Street, East Melbourne, VIC, Australia.

Disclaimer
The information contained herein is based on experience and is believed to be accurate and up to date as at the date of its preparation. However, uses and conditions of use are not within the manufacturer's control and users should determine the suitability of such products and methods of use for their purposes. Neither the manufacturer nor the seller makes any warranty of any kind, express or implied, statutory or otherwise, except that the products described herein shall conform to the manufacturer's or seller's specifications. The manufacturer and the seller expressly disclaim all other warranties, INCLUDING, WITHOUT LIMITATION, WARRANTIES CONCERNING MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. Under no circumstances shall the manufacturer or the seller be liable for indirect, special, consequential, or incidental damages without limitation, damages for lost or anticipated profits.

Emergency Contact Telephone Numbers
For chemical emergencies (24 hour) involving transportation, spill, leak, release, fire or accidents:
Canada: Orica Canada emergency response **1-877-561-3636**
USA: Chemtrec **1-800- 424-9300**

For lost, stolen or misplaced explosives:
USA: BAFT **1-800-800-3855**. Form ATF F5400.0 must be completed and local authorities (state / municipal police, etc) must be advised.

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301 Hotel De Ville
Brownsburg, QC J8G 3B5
Tel: +1 303 268 5000
Fax: +1 303 268 5250

Orica USA Inc.
33101 East Quincy Ave
Watkins, CO 80137
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Technical Data Sheet

The Power of Partnership

Senatel™ Magnafrac™

Description

Senatel™ *Magnafrac*™ packaged emulsion explosive is a robust, detonator sensitive explosive. The explosive is orange in color with a firm putty-like consistency. This product is also available in High Wax (HW) formulations.

Application

Senatel™ *Magnafrac*™ is a water resistant packaged explosive designed for priming applications, and as a medium density column explosive, in mining, quarry and construction, and general blasting work. The high detonation velocity and the robust nature of *Senatel*™ *Magnafrac*™ make it an ideal primer for the initiation of ANFO columns.

Senatel™ *Magnafrac*™ PMP film cartridges readily split during tamping to maximize coupling and bulk strength within a blasthole.

Key Benefits

- *Senatel*™ *Magnafrac*™ is a cost effective emulsion formulation suitable for a range of blasting applications.
- *Senatel*™ *Magnafrac*™ reduces post-blast fumes and improves turnaround time.
- *Senatel*™ *Magnafrac*™ can be loaded into 115 mm (4½ in.) diameter upholes *w*hen used with cartridge loading equipment.
- The tight diameter control specifications and wax formulation of *Senatel*™ *Magnafrac*™ maximizes cartridge loader performance.
- *Senatel*™ *Magnafrac*™ is highly water resistant that minimizes leaching and reduces environmental impact.
- OH&S issues around the handling and storage of nitroglycerin are eliminated.
- Provides excellent fragmentation with minimum throw.
- Packaged in PMP, easy to tamp plastic film or high strength, tear resistant Valeron film cartridges ideal for ragged, medium size boreholes.
- The packaging and emulsion color of *Senatel*™ *Magnafrac*™ provides high visibility in a range of environments.

Technical Properties

Senatel™ Magnafrac™ 32 x 400 mm (1 ¼ x 16 in.)		
Cartridge Density		1.11 g/cc
Velocity of Detonation[1]		5,000 m/s[3] 16,400 ft/s
Water Resistance		Excellent
Fume Class		1
Relative Effective Energy (REE) [2]	Relative Weight Strength (RWS)	91
	Relative Bulk Strength (RBS)	120

Packaging

Senatel™ *Magnafrac*™ is packaged in white plastic film to clearly differentiate it from booster sensitive packaged explosives. Cartridges are packed into 25 kg (55 lb) fiberboard cartons. Standard cartridge sizes are as follows:

Senatel™ Magnafrac™

Size (mm)	Size (in.)	Nominal count per case	Film Type
25 x 300	1 x 12	161(±6)	PMP
28 x 300	1 ⅛ x 12	120(±4)	PMP
28 x 400	1 ⅛ x 16	94(±4)	PMP
32 x 300	1 ¼ x 12	104(±4)	PMP
32 x 400	1 ¼ x 16	80(±4)	PMP
40 x 400	1 ½ x 16	51(±4)	PMP
45 x 200	1 ¾ x 8	73(±3)	PMP / Valeron
50 x 200	2 x 8	57(±2)	Valeron
50 x 400	2 x 16	26	Valeron
65 x 200	2 ½ x 8	34	Valeron
75 x 400	3 x 16	12	Valeron

Recommendations for Use

Blasthole Depth

Senatel™ *Magnafrac*™ is suitable for use in holes of any practical depth providing contained water does not exceed 20 m (65.6 ft.) depth.

Priming and Initiation

An Orica high strength electric, electronic, or non-electronic detonator can reliably initiate *Senatel*™ *Magnafrac*™ at temperatures higher than -15°C (5°F). At temperatures below -15°C (5°F), an appropriately sized *Pentex*™ Booster is recommended. Use of detonating cord with Senatel™ Magnafrac™ is not recommended. Detonating cord may adversely affect the performance of *Senatel*™ *Magnafrac*™ and could result in misfires. Consult an Orica representative before attempting to use with detonating cord.

Charging

In small diameter blastholes the maximum energy per meter of blasthole can be achieved by tamping the explosive with a wooden tamping rod appropriate to the hole diameter. No metal instrument should be used to tamp explosives. The primer cartridge containing a detonator must not be tamped.

Sleep Time Within Blastholes

The sleep time in a blasthole is influenced by the extent of damage to the packaging and by the nature of any water present. *Senatel*™ *Magnafrac*™ will give good performance after two weeks immersion.

Storage And Handling

Product Classification

Authorized Name:	*Senatel*™ *Magnafrac*™
Proper Shipping Name:	Explosive, blasting, type E
Classification:	1.1D
UN No:	0241
Packing Group:	II
EX Number:	2008020491

All regulations pertaining to the handling and use of such explosives apply.

Storage

Store *Senatel*™ *Magnafrac*™ in a suitably licensed magazine for Class 1.1D explosives. The cases should be stacked in the manner designated on the case.

Senatel™ *Magnafrac*™ has a storage **shelf life** of up to 12 months from manufacture date in a well ventilated, approved magazine, even in hot and humid extremes.

Senatel™ *Magnafrac*™ is best stored at temperatures above -15°C (5°F). This is especially important in cold weather "load and shoot" worksites where there is insufficient inhole warm-up time. *Senatel*™ *Magnafrac* ™ should have an internal temperature of 0°C (32°F) or higher, before use with a pneumatic cartridge loading machine.

For recommended good practices in transporting, storing, handling, and using this product, refer to the "Always and Never" booklet packed inside each case.

Transport

Senatel™ *Magnafrac*™ should be transported between -15°C (5°F) and +30°C (86°F).

Senatel™ Magnafrac™

Disposal

Disposal of explosives materials can be hazardous. Methods for safe disposal of explosives may vary depending on the user's situation. Please contact a local Orica representative for information on safe practices.

Safety

The post detonation fume characteristics of *Senatel*™ *Magnafrac*™ make the product suitable for both underground and surface blasting applications. Users should ensure that adequate ventilation is provided prior to re-entry into the blast area.

Senatel™ *Magnafrac*™ can be initiated by extremes of shock, friction or mechanical impact. As with all explosives, *Senatel*™ *Magnafrac*™ should be handled and stored with care and must be kept clear of flame and excessive heat.

Trademarks

Disclaimer

Emergency Contact Telephone Numbers

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Notes

1. VOD will depend on application including explosive density, blasthole diameter and degree of confinement. The VOD range is based on minimum unconfined and calculated ideal.
2. The Relative Effective Energy (REE) of an explosive is the energy calculated to be available to do effective blasting work. All energy values are calculated using the *IDeX*™ computer code owned by Orica for the exclusive use of its companies. Energy values are based on standard ANFO with a density of 0.84 g/cc and a cut-off pressure of 100Mpa. Other computer codes may give different values.
3. Unconfined at 5°C (41°F).

Technical Data Sheet

The Power of Partnership

Senatel™ Magnasplit™

Description

Senatel™ *Magnasplit*™ packaged emulsion explosive is a robust, detonator sensitive explosive. The explosive is orange in color with a firm putty-like consistency.

Application

Senatel™ *Magnasplit*™ is a paper wrapped, packaged explosive designed for wall control and perimeter blasting.

Key Benefits

- *Senatel*™ *Magnasplit*™ plastic couplers result in precise and easy loading, improving overall productivity.
- *Senatel*™ *Magnasplit*™ is used to provide smooth walls with minimum overbreak and reduces ground control costs and improves advance per round.
- *Senatel*™ *Magnasplit*™ is easy to prime as there are no holes to punch or detonating cord to stitch.
- *Senatel*™ *Magnasplit*™ is easy to position for optimal energy distribution.
- *Senatel*™ *Magnasplit*™ is highly water resistant to minimize leaching and reduce environmental impact.
- OH&S issues around the handling and storage of nitroglycerin are eliminated.
- The packaging and emulsion color of *Senatel*™ *Magnasplit*™ provides high visibility in a range of environments.

Technical Properties

Senatel™ Magnasplit™ 22 x 600 mm (7/8 x 24 in.)		
Cartridge Density		1.16 g/cc
Velocity of Detonation[1]		4,800 m/s 15,700 ft/s
Water Resistance		Excellent
Fume Class		3
Relative Effective Energy (REE)[2]	Relative Weight Strength (RWS)	96
	Relative Bulk Strength (RBS)	133

Packaging

Senatel™ *Magnasplit*™ is packed in spiral wound cartridges with quick connect plastic couplers. Cartridges are packed into 25 kg (55 lb) fiberboard cartons. The standard cartridge size is as follows:

Size (mm)	Size (in.)	Nominal count per case	Paper Type
22 x 600	7/8 x 24	93 (±3)	Spiral Wound

Recommendations for Use

Priming and Initiation

It is extremely important that cartridges are fully coupled during insertion into the borehole.

Vertical Borehole

- Prime the first cartridge with a high strength detonator.
- Make two cross hitches across the cartridge with the detonator wire or shock tube.
- Couple the second cartridge with the plastic coupler (included in each box).
- Push the cartridges together tightly so that the ends are touching.
- With subsequent cartridges use the plastic coupler to ensure that ends remain firmly in contact.
- To ensure you have adequate coupling, hold the detonator wire or shock tube firmly while using your hand to push the cartridges together to ensure that the cartridges remain in contact.

Horizontal Borehole

- Prime the first cartridge with a high strength detonator.
- Make two cross hitches across the cartridge with the detonator wire or shock tube.
- Couple the second cartridge with the plastic coupler (included in each box).
- To ensure you have adequate coupling, hold the detonating cord firmly while using your hand to push the cartridges together to ensure that cartridges remain in contact.
- Push the cartridges together tightly so ends are touching.
- With subsequent cartridges use the plastic coupler to ensure that ends remain in firmly in contact.

Please contact an Orica Technical Service Representative with any questions.

Sleep Time Within Blastholes

The sleep time in a blasthole is influenced by the extent of damage to the packaging and by the nature of any water present.

Storage And Handling

Product Classification

Authorized Name:	*Senatel*™ *Magnasplit*™
Proper Shipping Name:	Explosive, blasting, type E
Classification:	1.1D
UN No:	0241
Packing Group:	II
EX Number:	1998080199A

All regulations pertaining to the handling and use of such explosives apply.

Storage

Store *Senatel*™ *Magnasplit*™ in a suitably licensed magazine for Class 1.1D explosives. The cases should be stacked in the manner designated on the case.

Senatel™ *Magnasplit*™ has a storage **shelf life** of up to 12 months from manufacture date in a well ventilated, approved magazine, even in hot and humid extremes.

Senatel™ *Magnasplit*™ is best stored at temperatures above -15°C (5°F). This is especially important in cold weather “load and shoot” worksites where there is insufficient inhole warm-up time.

For recommended good practices in transporting, storing, handling, and using this product, refer to the “Always and Never” booklet packed inside each case.

Transport

Senatel™ *Magnasplit*™ should be transported between -40°C (-40°F) and +40°C (104°F).

Disposal

Disposal of explosives materials can be hazardous. Methods for safe disposal of explosives may vary depending on the user's situation. Please contact a local Orica representative for information on safe practices.

Safety

The post detonation fume characteristics of *Senatel*™ *Magnasplit*™ make the product suitable for both underground and surface blasting applications. Users should ensure that adequate ventilation is provided prior to re-entry into the blast area.

Senatel™ *Magnasplit*™ can be initiated by extremes of shock, friction or mechanical impact. As with all explosives, *Senatel*™ *Magnasplit*™ should be handled and stored with care and must be kept clear of flame and excessive heat.

Trademarks

Disclaimer

CONCERNING MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. Under no circumstances shall the manufacturer or the seller be liable for indirect, special, consequential, or incidental damages without limitation, damages for lost or anticipated profits. Explosives based on Ammonium Nitrate such as *Senatel™ Magnasplit™* may react with pyritic materials in the ground and create potentially hazardous situations. Orica accepts no responsibility for any loss or liability arising from use of the product in ground containing pyritic or other reactive material.

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USA: Chemtrec **1-800- 424-9300**

For lost, stolen or misplaced explosives:
USA: BATFE **1-800-800-3855**. Form ATF F5400.0 must be completed and local authorities (state / municipal police, etc) must be advised.

Notes

1. Unconfined at 5ºC (41ºF). VOD will depend on application including explosive density, blasthole diameter and degree of confinement. The VOD range is based on minimum unconfined and calculated ideal
2. The Relative Effective Energy (REE) of an explosive is the energy calculated to be available to do effective blasting work. All energy values are calculated using the *IDeX™* computer code owned by Orica for the exclusive use of its companies. Energy values are based on standard ANFO with a density of 0.84 g/cc and a cut-off pressure of 100Mpa. Other computer codes may give different values.

Technical Data Sheet

Senatel™ Powersplit™

The Power of Partnership

Description

Senatel™ *Powersplit*™ detonator sensitive emulsion explosive is internally traced with 10 g/m detonating cord that ensures fast and complete detonation. The emulsion is off-white in color with a putty-like consistency.

Application

Senatel™ *Powersplit*™ is designed for blasting operations where a continuous length of decoupled explosive charge is required. *Senatel*™ *Powersplit*™ suits perimeter blasting applications such as smooth wall blasting, trimming and pre-splitting.

Key Benefits

- *Senatel*™ *Powersplit*™ is fast to load into blastholes due to the internally traced high strength detonating cord.
- The small diameter, high velocity of detonation, and low decoupled energy of *Senatel*™ *Powersplit*™ minimizes blast damage to the walls leaving behind a smooth profile with minimal overbreak.
- *Senatel*™ *Powersplit*™ is water resistant and can be used in wet and dry blastholes.
- The center traced detonating cord in *Senatel*™ *Powersplit*™ ensures reliable detonation of the decoupled charge.
- Colored caps on each end for easy identification when opening a case.
- *Senatel*™ *Powersplit*™ has high sensitivity, excellent stability, and superior water performance as compared to watergels.

Technical Properties

Senatel™ Powersplit™		
Cartridge Density		1.30 g/cc
Typical Velocity of Detonation[1]		7,000 m/s 23,000 ft/s
Water Resistance		Excellent
Fume Class		1
Relative Effective Energy (REE) [2]	Relative Weight Strength (RWS)	109
	Relative Bulk Strength (RBS)	162

Packaging

Senatel™ *Powersplit*™ is packaged in continuous Valeron film and double clipped every 400mm (15¾ in.). *Senatel*™ *Powersplit*™ is packaged in white plastic film to clearly differentiate it from booster sensitive packaged explosives. Standard cartridge sizes are as follows:

Size		Load Factor		Cartridges / case
(mm x m)	(in. x ft.)	kg/m	lb/ft.	1 @
22 x 53	⅞ x 173	0.48	0.32	130 links (±5)
28 x 34	1⅛ x 112	0.79	0.53	84 links (±5)
32 x 26	1¼ x 84	0.95	0.64	63 links (±3)
40 x 17	1½ x 55	1.49	1.00	41 links (±3)
45 x 13	1¾ x 43	1.80	1.21	32 links (±2)
50 x 10	2 x 33	2.38	1.60	25 links (±1)

Recommendations For Use

For more information consult the “How to guide for tying-in *Senatel*™ *Powersplit*™ in vertical and horizontal holes” or your Orica Technical Representative.

Sleep Time Within Blastholes

In dry blastholes, given that the explosives packaging is undamaged, *Senatel™ Powersplit™* may be charged and fired several months later. In wet blastholes, sleeping of the explosive is not recommended due to seepage of water into any exposed ends of the detonating cord. If in doubt when using *Senatel™ Powersplit™*, contact your local Orica sales office.

Re-entry period after firing

When using packaged explosive and detonating cord systems, in pre-split applications, consideration must be given to increasing the routine re-entry period after firing. In pre-split applications rare incidents of post-blast events have been observed. In most instances these events have been in the form of flaring or rumbling of the muckpile.

Post blast events typically occur seconds after the blast, but events have been noted after several minutes. One event occurred nearly 30 minutes after the blast.

If holes are stemmed, additional care must be taken in setting re-entry times. The use of stemming has been seen to increase the period between the shot and any post blast events. Where holes are stemmed it is also recommended that no potentially combustible materials are used, and re-entry periods must account for any post detonation fumes being trapped in the muckpile. Please consult your local Orica technical representative for advice.

Storage and Handling

Product Classification

Authorized Name:	*Senatel™ Powersplit™*
Proper Shipping Name:	Explosive, blasting, type E
Classification:	1.1D
UN No:	0241
Packing Group:	II
EX Number:	2008020491

All regulations on the handling and use of such explosives apply.

Storage

Store *Senatel™ Powersplit™* in a suitably licensed magazine for Class 1.1D explosives. The cases should be stacked in the manner designated on the case.

Senatel™ Powersplit™ has a **shelf life** of up to 18 months in a well-ventilated, approved magazine, even in hot and humid extremes. *Senatel™ Powersplit™* is best stored at temperatures above -15°C (5°F).

Transport

Senatel™ Powersplit™ should be transported between -40°C (-40ºF) and +40°C (104ºF).

Disposal

Disposal of explosives materials can be hazardous. Methods for safe disposal of explosives may vary depending on the user's situation. Please contact a local Orica representative for information on safe practices.

Safety

The post detonation fume characteristics of *Senatel™ Powersplit™* make the product suitable for surface blasting applications. Users should ensure that adequate ventilation is provided prior to re-entry into the blast area.

Senatel™ Powersplit™ can be initiated by extremes of shock, friction or mechanical impact. As with all explosives, keep *Senatel™ Powersplit™* clear of flame and excessive heat.

Trademarks

Disclaimer

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preparation. However, uses and conditions of use are not within the manufacturer's control and users should determine the suitability of such products and methods of use for their purposes. Neither the manufacturer nor the seller makes any warranty of any kind, express or implied, statutory or otherwise, except that the products described herein shall conform to the manufacturer's or seller's specifications. The manufacturer and the seller expressly disclaim all other warranties, INCLUDING, WITHOUT LIMITATION, WARRANTIES CONCERNING MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. Under no circumstances shall the manufacturer or the seller be liable for indirect, special, consequential, or incidental damages without limitation, damages for lost or anticipated profits. Explosives based on Ammonium Nitrate such as *Senatel*™ *Powersplit*™ may react with pyritic materials in the ground and create potentially hazardous situations. Orica accepts no responsibility for any loss or liability arising from use of the product in ground containing pyritic or other reactive material.

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Notes

1. Unconfined at 5ºC (41ºF). VOD will depend on application including explosive density blasthole diameter and degree of confinement. The VOD range is based on minimum unconfined and calculated ideal.
2. The Relative Effective Energy (REE) of an explosive is the energy calculated to be available to do effective blasting work. All energy values are calculated using the *IDeX*™ computer code owned by Orica for the exclusive use of its companies. Energy values are based on standard ANFO with a density of 0.84 g/cc and a cut-off pressure of 100Mpa. Other computer codes may give different values.

Material Safety Data Sheet

Preparation Date: 18-Feb-2008 **Revision Date:** 2-April-2009 **Revision Number:** 1

SECTION 1 – PRODUCT AND COMPANY IDENTIFICATION

Supplier(s):

Orica Canada Inc.
Maple Street
Brownsburg, QC
For MSDS Requests: 1-450-533-4201

Orica USA Inc.
33101 E. Quincy Avenue
Watkins, CO 80137-9406
For MSDS Requests: 1-303-268-5000

Product Name:	**Centra™ Control 25, 30, 40, 50, 70, 80, 100 & ANE (USA)**
Product Code:	2120
Alternate Name(s):	Apex™ Gold 2502 Series
UN-No:	UN0332
Recommended Use:	A booster sensitive emulsion explosive.

Emergency Telephone Number: FOR CHEMICAL EMERGENCIES (24 HOUR) INVOLVING TRANSPORTATION, SPILL, LEAK, RELEASE, FIRE OR ACCIDENTS: **IN CANADA CALL:** THE ORICA TRANSPORTATION EMERGENCY RESPONSE SYSTEM AT **1-877-561-3636. IN THE U.S. CALL: CHEMTREC 1-800-424-9300. IN THE U.S.:** FOR LOST, STOLEN, OR MISPLACED EXPLOSIVES CALL: BATF **1-800-800-3855.** FORM ATF F 5400.0 MUST BE COMPLETED AND LOCAL AUTHORITIES (STATE/MUNICIPAL POLICE, ETC.) MUST BE ADVISED.

SECTION 2 – HAZARD IDENTIFICATION

Emergency Overview:
Risk of explosion by shock, fire of other sources of ignition. May cause skin irritation and/or dermatitis. This product contains one or more substances, which are classified in the EU as carcinogenic, mutagenic and/or reprotoxic. Irritating to eyes. Harmful if swallowed. Oxidizing agent. May cause methemoglobinemia. May cause liver damage. May cause kidney damage.

Appearance:	**Physical State:**	**Odor:**
Pink, viscous putty-like	Viscous, putty-like	Diesel

SECTION 3 – COMPOSITION / INFORMATION ON INGREDIENTS

Chemical Name	**CAS-No**	**Weight %**
Ammonium Nitrate	6484-52-2	60-80
Diesel Fuel	68476-34-6	1-6
Mineral Oil	64742-53-6	1-6

Note: Diesel Fuel may be substituted for Mineral Oil in the emulsion matrix component.

SECTION 4 – FIRST AID MEASURES

General Advice:	In case of accident or if you feel unwell, seek medical advice IMMEDIATELY (show the product label where possible).
Eye Contact:	Immediately flush with plenty of water. After initial flushing, remove any contact lenses and continue flushing for at least 15 minutes. Immediate medical attention is required.
Skin Contact:	Wash off immediately with soap and plenty of water, removing all contaminated clothes and shoes. If skin irritation persists, call a physician.
Inhalation:	Move victim to fresh air. Give artificial respiration ONLY if breathing has stopped. Give cardiopulmonary resuscitation (CPR) if there is no breathing AND no pulse. Obtain medical advice IMMEDIATELY.
Ingestion:	Immediate medical attention is required. Do no induce vomiting. Clean mouth with water and afterwards drink plenty of water. If spontaneous vomiting occurs, have victim lean forward with head positioned to avoid breathing in of vomitus, rinse mouth and administer more water. Never give anything by mouth to and unconscious person.

Notes to physician: Symptomatic. Administer oxygen if there are signs of cyanosis. If clinical condition deteriorates, administer 10cc Methylene Blue intravenously. It is unlikely for this to be required with methemoglobin level of less than 40%.

SECTION 5 – FIRE-FIGHTING MEASURES

Flammable properties: Not itself combustible but assists fire in burning materials. The product does not flash. Rate of burning: does not sustain burning at atmospheric pressure.

Suitable extinguishing media: DO NOT FIGHT FIRES INVOLVING EXPLOSIVES. Evacuate surrounding areas. When controlling fire before involvement of explosives, fire-fighters should wear positive pressure self-containing breathing apparatus (SCBA) and full turnout gear. Water may be applied through fixed extinguishing system (sprinklers) as long as people need not be present for the system to operate.

Unsuitable extinguishing media: DO NOT FIGHT FIRES INVOLVING EXPLOSIVES. Attempts to smother a fire involving this product will be ineffective as it is its own oxygen source. Smother this product could lead to decomposition and explosion. This product is more sensitive to detonation if contaminated with organic or oxidisable material or if heated while confined. Unless the mass of product on fire is flooded with water, re-ignition is possible.

Specific hazards arising from the chemical: This product is a high explosive with mass detonation hazard. DO NOT FIGHT FIRES INVOLVING EXPLOSIVE MATERIALS. Immediately evacuate all personnel from the area to a safe distance. Guard against re-entry. Thermal decomposition can lead to release of irritating gases and vapors.

Protective equipment and precautions for firefighters: As in any fire, wear self-contained breathing apparatus pressure-demand, NIOSH approved (or equivalent) and full protective gear.

SECTION 6 – ACCIDENTAL RELEASE MEASURES

Methods for containment: Contain or absorb leaking putty with sand or earth or other suitable substance.

Methods for cleaning up: Avoid the use of metal tools containing iron and/or copper. Be careful to avoid shock, friction, and contact with grit. Collect product for recovery or disposal. For release to land, contain discharge by constructing dykes or applying inert absorbent; for release to water, utilize damming and/or water diversion to minimize the spread of contamination. Collect contaminated soil and water, and absorbent for proper disposal. Notify applicable government authority if release is reportable or could adversely affect the environment.

Other information: Deactivating chemicals: Detergents will break up emulsions if mixed in.

SECTION 7 – HANDLING AND STORAGE

Handling: This product is an explosive and should only be used under the supervision of trained personnel. The use of coveralls is recommended. Use good industrial hygiene and housekeeping practices. Keep away from open flames, hot surfaces and sources of ignition.

Storage: Store under moderate temperatures recommended by a technical services representative. Store under dry conditions in a well ventilated magazine that has been approved for either detonator storage or explosive storage. Do NOT store explosives in a detonator magazine or detonators in an explosive magazine. Keep away from heat, spark and flames. Keep containers closed. Explosives should be kept well away from initiating explosives; protected from physical damage; separated from oxidizing materials; combustibles, and sources of heat. Keep away from incompatibles. Ideal storage temperature is 10-27°C (50-80°F). Do not expose sealed containers to temperatures above 40°C (104°F).

SECTION 8 – EXPOSURE CONTROLS/PERSONAL PROTECTION

Chemical Name	ACGIH TLV	OSHA PEL	NIOSH IDLH
Diesel Fuel	TWA: 100 mg/m³ Skin		
Mineral Oil	5 mg/m^3	5 mg/m^3	

Other exposure guidelines: Ammonium Nitrate: ORICA Guideline 5 mg/m^3 (internal TWA)

Engineering Measures: No information available.

Personal Protective Equipment

Eye/Face Protection: Tightly fitting safety goggles.

Skin Protection: User should verify impermeability under normal conditions of use prior to general use. Impervious butyl rubber gloves.

Respiratory Protection: In case of insufficient ventilation wear suitable respiratory equipment. A NIOSH-approved respirator, if required.

Hygiene Measures: Handle in accordance with good industrial hygiene and safety practice. Recommendations listed in this section indicate the type of equipment, which will provide protection against over exposure to this product. Conditions of use, adequacy of engineering or other control measures, and actual exposures will dictate the need for specific protective devices at your workplace.

SECTION 9 – PHYSICAL AND CHEMICAL PROPERTIES

Appearance:	Pink, viscous putty-like	**Odor:**	Diesel
Physical State:	Viscous, putty-like	**Viscosity:**	No information available
pH:	4- 6	**Flash Point:**	Not applicable
Autoignition Temperature:	230-265°C/ 446-509°F	**Boiling Point/Range:**	None
Melting Point/Range:	Not available	**Flammable Limits (Upper):**	Not applicable
Flammable Limits (Lower):	Not applicable	**Explosion Power:**	No data available
Specific Gravity:	1.20 – 1.30 g/cc	**Water Solubility:**	Negligible
Other Solubility:	No data available	**Vapor Pressure:**	0 mmHg @ 20°C
Oxidizing Properties:	Oxidizer	**Partition Coefficient (n-octanol/water):**	No data available

SECTION 10 – STABILITY AND REACTIVITY

Stability: Stable under normal conditions. Decomposition Temperature: Ammonium Nitrate will spontaneously decompose at 210°C (410°F).

Conditions to avoid: Keep away from open flames, hot surfaces and sources of ignition. Not expected to be sensitive to static discharge. Not expected to be sensitive to mechanical impact.

Incompatible materials: Avoid oxidizable materials, metal powder, bronze & copper alloys, fuels (e.g. lubricants, machine oils), fluorocarbon lubricants, acids, corrosive liquids, chlorate, sulphur, sodium nitrite, charcoal, coke and other finely divided combustibles. Strong oxidizing and reducing agents.

Hazardous decomposition products: The following toxic decomposition products may be released. At temperatures above 210°C (410°F), decomposition may be explosive, especially if confined. Nitrogen oxides (NOx). Carbon oxide. Hydrocarbons.

Hazardous Polymerization: None under normal processing. Hazardous polymerization does not occur. Explosive material under shock conditions.

SECTION 11 – TOXICOLOGICAL INFORMATION

Acute Toxicity

Product Information: Irritating to eyes. May cause skin irritation. Harmful if swallowed.

Chemical name	LD50 Oral	LD50 Dermal	LC50 Inhalation
Ammonium Nitrate	2217 mg/kg Rat	3000 mg/kg Rabbit	88.8 mg/L Rat 4 h
Diesel Fuel	>5000 mg/kg (rabbit)		
Mineral Oil	4300 mg/kg Rat		

Subchronic Toxicity (28 Days): Ammonium Nitrate: Ingestion may cause methemoglobinemia. Initial manifestation of methemoglobinemia is cyanosis, characterized by navy lips, tongue and mucous membranes, with skin color being slate grey. Further manifestation is characterized by headache, weakness, dyspnea, dizziness, stupor, respiratory distress and death due to anoxia. If ingested, nitrates may be reduced to nitrites by bacteria in the digestive tract. Signs and symptoms of nitrite poisoning include methemoglobinemia, nausea, dizziness, increased heart rate, hypotension, fainting and, possibly shock.

Chronic Toxicity: May cause methemoglobinemia.

Carcinogenicity: The table below indicates whether each agency has listed any ingredient as a carcinogen.

Chemical name	ACGIH	IARC	NTP	OSHA
Diesel Fuel	A3			

Legend: A3: Confirmed as an animal carcinogen.
Mutagenic effects: There is no evidence of mutagenic potential.

Irritation: Irritating to eyes. May cause irritation of respiratory tract. May cause skin irritation in susceptible persons.
Reproductive effects: No information is available and no adverse reproductive effects are anticipated.
Developmental effects: No information is available and no adverse developmental effects are anticipated.
Target Organ: Eyes, skin, respiratory system, blood, liver, urinary tract, gastrointestinal tract (GI), endocrine system, & immune system.

SECTION 12 – ECOLOGICAL INFORMATION

Ecotoxicity effects: Dissolves slowly in water. Harmful to aquatic life at low concentrations.
Environmental Effects: Can be dangerous if allowed to enter drinking water intakes. Do not contaminate domestic or irrigation water supplies, lakes, streams, ponds, or rivers.

Persistence/Degradability: Some water resistance but soluble with extended time periods.

Mobility in Environmental media: Dissolves slowly in water.

SECTION 13 – DISPOSAL CONSIDERATIONS

Waste Disposal Method: Burn under supervision of an expert at an explosive burning ground or destroy by detonation in boreholes, in accordance with applicable local, provincial and federal regulations. Call upon the services of an Orica Technical Representative.

SECTION 14 – TRANSPORT INFORMATION

DOT Proper Shipping Name: Explosive blasting type E
Hazard Class: 1.5D
UN-No: UN0332
Packing group: II
TDG Proper Shipping Name: Explosive blasting type E
Hazard Class: 1.5D
UN-No: UN0332
Packing group: II

Transportation Emergency Telephone Number: 1-877-561-3636 or CHEMTREC: 1-800-424-9300

SECTION 15 – REGULATORY INFORMATION

CANADIAN CLASSIFICATION: This product has been classified in accordance with the hazard criteria of the CPR (Controlled Products Regulations) and this MSDS contains all the information required by the CPR

WHMIS hazard class: This product is an explosive and is not regulated by WHMIS.
USA CLASSIFICATION:
SARA Regulations Sections 313 and 40 CFR 372: This product contains the following toxic chemical(s) subject to reporting requirements, Ammonium Nitrate (6484-52-2).
SARA 311/312 Hazardous Categorization
Acute Heath Hazard: Yes
Chronic Health Hazard: Yes
Fire Hazard: Yes
Reactive Hazard: No
Sudden Release of Pressure Hazard: Yes
Ozone Protection and 40 CFR 42: No reportable quantities of ozone depleting agents
Other Regulations/Legislations which apply to this product: New Jersey Right-to-Know, Pennsylvania Right-to-Know, Massachusetts Right-to-Know, Rhode Island Right-to-Know, Florida, New Jersey Special Health Hazard Substance List, Minnesota Hazardous Substance List, California Director's List of Hazardous Substances, California Proposition 65.

TSCA: Complies **DSL:** Complies **NDSL:** Complies

The components in the product are on the following international inventory lists:

Chemical Name	TSCA	DSL	NDSL	ENCS	EINECS	ELINCS	CHINA	KECL	PICCS	AICS
Ammonium Nitrate	X	X	-	X	X	-	X	X	X	X
Diesel Fuel	X	X	-	-	X	-	X	X	X	X
Mineral Oil	X	X	-	-	X	-	X	X	X	X

Legend: X – Listed

SECTION 16 – OTHER INFORMATION

Prepared by: **Safety Health & Environment**
303-268-5000

Preparation Date: 18-Feb-2008
Revision Date: 2-April-2009

The information contained herein is offered only as guide to the handling of this specific material and has been prepared in good faith by technically knowledgeable personnel. It is not intended to be all-inclusive and the manner and conditions of use and handling may involve other and additional considerations. No warranty of any kind is given or implied and Orica will not be liable for any damages, losses, injuries or consequential damages which may result from the use of or reliance on any information contained herein.

End of MSDS

Material Safety Data Sheet

Preparation Date: 31-Jul-2006 **Revision Date:** 28-April-2009 **Revision Number:** 1

SECTION 1 – PRODUCT AND COMPANY IDENTIFICATION

Supplier(s):

Orica Canada Inc.
Maple Street
Brownsburg, QC
For MSDS Requests: 1-450-533-4201

Orica USA Inc.
33101 E. Quincy Avenue
Watkins, CO 80137-9406
For MSDS Requests: 1-303-268-5000

Product Name: **Centra™ Gold 70, Centra™ Gold 100 & Centra™ Gold ANE (USA)**
Product Code: 2161
Alternate Name(s): Apex™ Gold 2501 Series & Apex™ Gold 2101 Series
UN-No: UN3139
Recommended Use: Can be sensitized to become a booster sensitive emulsion explosive.

Emergency Telephone Number: FOR CHEMICAL EMERGENCIES (24 HOUR) INVOLVING TRANSPORTATION, SPILL, LEAK, RELEASE, FIRE OR ACCIDENTS: **IN CANADA CALL:** THE ORICA TRANSPORTATION EMERGENCY RESPONSE SYSTEM AT **1-877-561-3636. IN THE U.S. CALL: CHEMTREC 1-800-424-9300. IN THE U.S.:** FOR LOST, STOLEN, OR MISPLACED EXPLOSIVES CALL: BATF **1-800-800-3855.** FORM ATF F 5400.0 MUST BE COMPLETED AND LOCAL AUTHORITIES (STATE/MUNICIPAL POLICE, ETC.) MUST BE ADVISED.

SECTION 2 – HAZARD IDENTIFICATION

Emergency Overview:
Risk of explosion by shock, fire of other sources of ignition. May cause skin irritation and/or dermatitis. This product contains one or more substances, which are classified in the EU as carcinogenic, mutagenic and/ or reprotoxic. Irritating to eyes. Harmful if swallowed. Oxidizing agent. May cause methemoglobinemia. May cause liver damage. May cause kidney damage.

Appearance:	**Physical State:**	**Odor:**
Pink, viscous, putty-like	Viscous, putty-like	Diesel/ Vinegar like

SECTION 3 – COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Name	**CAS-No**	**Weight %**
Ammonium Nitrate	6484-52-2	70-80
Mineral Oil	64742-53-6	1-6
Diesel Fuel	68476-34-6	1-6
Thiourea	62-56-6	0.1-1
Acetic Acid	64-19-7	0.1-1

Note: 100% of Diesel Fuel may be substituted for Mineral Oil in Emulsion Matrix Component

SECTION 4 – FIRST AID MEASURES

General Advice: In case of accident or if you feel unwell, seek medical advice IMMEDIATELY (show the product label where possible).

Eye Contact: Immediately flush with plenty of water. After initial flushing, remove any contact lenses and continue flushing for at least 15 minutes. Immediate medical attention is required.

Skin Contact: Wash off immediately with soap and plenty of water, removing all contaminated clothes and shoes. If skin irritation persists, call a physician.

Inhalation: Move victim to fresh air. Give artificial respiration ONLY if breathing has stopped. Give cardiopulmonary resuscitation (CPR) if there is no breathing AND no pulse. Obtain medical advice IMMEDIATELY.

Ingestion: Immediate medical attention is required. Do no induce vomiting. Clean mouth with water and afterwards drink plenty of water. If spontaneous vomiting occurs, have victim lean forward with

head positioned to avoid breathing in of vomitus, rinse mouth and administer more water. Never give anything by mouth to and unconscious person.

Notes to physician: Symptomatic. Administer oxygen if there are signs of cyanosis. If clinical condition deteriorates, administer 10cc Methylene Blue intravenously. It is unlikely for this to be required with methemoglobin level of less than 40%.

SECTION 5 – FIRE-FIGHTING MEASURES

Flammable properties: Not itself combustible but assists fire in burning materials. The product does not flash. Rate of burning: attempts to smother a fire involving this product will be ineffective as it is its own oxygen source.

Suitable extinguishing media: Use Water only, in as much volume as possible to cool the burning mass quickly. Chemical extinguishers will not work. Fire-fighters should wear positive pressure self-containing breathing apparatus (SCBA) and full turnout gear. Water may be applied through fixed extinguishing system (sprinklers) as long as people need not be present for the system to operate.

Unsuitable extinguishing media: Chemical extinguishers will not work. Attempts to smother a fire involving this product will be ineffective as it is its own oxygen source. Smother this product could lead to decomposition and explosion. This product is more sensitive to detonation if contaminated with organic or oxidisable material or if heated while confined. Unless the mass of product on fire is flooded with water, re-ignition is possible.

Specific hazards arising from the chemical: Toxic gases and vapours will be released by the thermal decomposition of this material. At higher temperatures, decomposition may be explosive, especially if confined. Immediately evacuate all personnel from the area to a safe distance. Guard against re-entry.

Protective equipment and precautions for firefighters: As in any fire, wear self-contained breathing apparatus pressure-demand, NIOSH approved (or equivalent) and full protective gear.

SECTION 6 – ACCIDENTAL RELEASE MEASURES

Methods for containment: Contain or absorb leaking putty with sand or earth or other suitable substance.

Methods for cleaning up: Avoid the use of metal tools containing iron and/or copper. Be careful to avoid shock, friction, and contact with grit. Collect product for recovery or disposal. For release to land, contain discharge by constructing dykes or applying inert absorbent; for release to water, utilize damming and/or water diversion to minimize the spread of contamination. Collect contaminated soil and water, and absorbent for proper disposal. Notify applicable government authority if release is reportable or could adversely affect the environment.

Other information: Deactivating chemicals: Detergents will break up emulsions if mixed in.

SECTION 7 – HANDLING AND STORAGE

Handling: Avoid contact with eyes or skin. Wash thoroughly with soap and water after handling. Wash clothing before re-use. Locate safety shower and eyewash station closest to chemical handling area. The use of coveralls is recommended. Use good industrial hygiene and housekeeping practices. Keep away from open flames, hot surfaces and sources of ignition

Storage: Store in a cool, well-ventilated area. Keep away from heat, sparks, and flames. Keep storage containers closed. Store at 10-27°C (50-80°F). Do not expose closed containers to temperatures above 40°C (104°F). Product is mildly corrosive to concrete and steel. Stainless steel and aluminium are adequate. Avoid materials made of copper, iron, or bronze.

SECTION 8 – EXPOSURE CONTROLS/PERSONAL PROTECTION

Chemical Name	ACGIH TLV	OSHA PEL	NIOSH IDLH
Mineral oil	5 mg/m³	5 mg/ m³	
Diesel Fuel	TWA: 100 mg/m³ Skin		
Acetic Acid	10 ppm	10 ppm	

Other exposure guidelines: Ammonium Nitrate: ORICA Guideline 5 mg/m^3 (internal TWA)

Engineering Measures: No information available.

Personal Protective Equipment

Eye/Face Protection: Tightly fitting safety goggles.

Skin Protection: User should verify impermeability under normal conditions of use prior to general use. Impervious butyl rubber gloves.

Respiratory Protection: In case of insufficient ventilation wear suitable respiratory equipment. A NIOSH-approved respirator, if required.

Hygiene Measures: Handle in accordance with good industrial hygiene and safety practice. Recommendations listed in this section indicate the type of equipment, which will provide protection against over exposure to this product. Conditions of use, adequacy of engineering or other control measures, and actual exposures will dictate the need for specific protective devices at your workplace.

SECTION 9 – PHYSICAL AND CHEMICAL PROPERTIES

Appearance:	Pink, viscous putty-like	**Odor:**	Diesel/ Vinegar like
Physical State:	Putty-like	**Viscosity:**	No information available
pH:	3 - 6	**Flash Point:**	Not applicable
Autoignition Temperature:	230-265°C/ 446-509°F	**Boiling Point/Range:**	None
Melting Point/Range:	Not available	**Flammable Limits (Upper):**	Not applicable
Flammable Limits (Lower):	Not applicable	**Explosion Power:**	No data available
Specific Gravity:	1.20 – 1.35 g/cc	**Water Solubility:**	Slightly soluble
Other Solubility:	Slightly soluble in standard organic solvents.	**Vapor Pressure:**	0 mmHg @ 20°C
Oxidizing Properties:	Oxidizer	**Partition Coefficient (n-octanol/water):**	No data available

SECTION 10 – STABILITY AND REACTIVITY

Stability: Stable under normal conditions. Decomposition Temperature: Ammonium Nitrate will spontaneously decompose at 210°C (410°F).

Conditions to avoid: Keep away from open flames, hot surfaces and sources of ignition. Not expected to be sensitive to static discharge. Not expected to be sensitive to mechanical impact.

Incompatible materials: Avoid oxidizable materials, metal powder, bronze & copper alloys, fuels (e.g. lubricants, machine oils), fluorocarbon lubricants, acids, corrosive liquids, chlorate, sulphur, sodium nitrite, charcoal, coke and other finely divided combustibles. Strong oxidizing and reducing agents.

Hazardous decomposition products: The following toxic decomposition products may be released. At temperatures above 210°C (410°F), decomposition may be explosive, especially if confined. Nitrogen oxides (NOx). Carbon oxide. Hydrocarbons.

Hazardous Polymerization: None under normal processing. Hazardous polymerization does not occur. Explosive material under shock conditions.

SECTION 11 – TOXICOLOGICAL INFORMATION

Acute Toxicity

Product Information: Irritating to eyes. May cause skin irritation. Harmful if swallowed.

Chemical name	LD50 Oral	LD50 Dermal	LC50 Inhalation
Ammonium Nitrate	2217 mg/kg Rat	3000 mg/kg Rabbit	88.8 mg/L Rat 4 h
Mineral Oil	4300 mg/kg Rat		
Diesel Fuel	>5000 mg/kg Rabbit		
Thiourea	125 mg/kg Rat		
Acetic Acid	3310 mg/kg Rat	1.06 g/kg Rabbit	5620 ppm/ 1 h Mouse

Subchronic Toxicity (28 Days): Ammonium Nitrate: Ingestion may cause methemoglobinemia. Initial manifestation of methemoglobinemia is cyanosis, characterized by navy lips, tongue and mucous membranes, with skin color being slate grey. Further manifestation is characterized by headache, weakness, dyspnea, dizziness, stupor, respiratory distress and death due to anoxia. If ingested, nitrates may be reduced to nitrites by bacteria in the digestive tract. Signs and

symptoms of nitrite poisoning include methemoglobinemia, nausea, dizziness, increased heart rate, hypotension, fainting and, possibly shock.

Chronic Toxicity: May cause methemoglobinemia.
Carcinogenicity: The table below indicates whether each agency has listed any ingredient as a carcinogen.

Chemical name	ACGIH	IARC	NTP	OSHA
Diesel Fuel	A3			
Thiourea		3	Anticipated	

Legend: A3: Confirmed as an animal carcinogen.
IARC 3: The agent (mixture or exposure circumstance) is not classifiable as to its carcinogenicity to humans
Mutagenic effects: There is no evidence of mutagenic potential.
Irritation: Irritating to eyes. May cause irritation of respiratory tract. May cause skin irritation in susceptible persons.
Reproductive effects: No information is available and no adverse reproductive effects are anticipated.
Developmental effects: No information is available and no adverse developmental effects are anticipated.
Target Organ: Eyes, skin, respiratory system, blood, liver, urinary tract, gastrointestinal tract (GI), endocrine system, & immune system.

SECTION 12 – ECOLOGICAL INFORMATION

Ecotoxicity effects: Dissolves slowly in water. Harmful to aquatic life at low concentrations.
Environmental Effects: Can be dangerous if allowed to enter drinking water intakes. Do not contaminate domestic or irrigation water supplies, lakes, streams, ponds, or rivers.

Persistence/Degradability: Some water resistance but soluble with extended time periods.

Mobility in Environmental media: Dissolves slowly in water.

SECTION 13 – DISPOSAL CONSIDERATIONS

Waste Disposal Method: Burn under supervision of an expert at an explosive burning ground or destroy by detonation in boreholes, in accordance with applicable local, provincial and federal regulations. Call upon the services of an Orica Technical Representative.

SECTION 14 – TRANSPORT INFORMATION

DOT Proper Shipping Name: Oxidizing substance, liquid. N.O.S. (Ammonium Nitrate)
Hazard Class: 5.1
UN-No: UN3139
Packing group: II

Transportation Emergency Telephone Number: 1-877-561-3636 or CHEMTREC: 1-800-424-9300

SECTION 15 – REGULATORY INFORMATION

USA CLASSIFICATION:
SARA Regulations Sections 313 and 40 CFR 372: This product contains the following toxic chemical(s) subject to reporting requirements, Ammonium Nitrate (6484-52-2).
SARA 311/312 Hazardous Categorization
Acute Heath Hazard: Yes
Chronic Health Hazard: Yes
Fire Hazard: Yes
Reactive Hazard: No
Sudden Release of Pressure Hazard: Yes
Ozone Protection and 40 CFR 42: No reportable quantities of ozone depleting agents

Other Regulations/Legislations which apply to this product: New Jersey Right-to-Know, Pennsylvania Right-to-Know, Massachusetts Right-to-Know, Rhode Island Right-to-Know, Florida, New Jersey Special Health Hazard Substance List, Minnesota Hazardous Substance List, California Director's List of Hazardous Substances, California Proposition 65.

TSCA: Complies **DSL:** Complies **NDSL:** Complies

The components in the product are on the following international inventory lists:

Chemical Name	TSCA	DSL	NDSL	ENCS	EINECS	ELINCS	CHINA	KECL	PICCS	AICS
Ammonium Nitrate	X	X	-	X	X	-	X	X	X	X
Mineral Oil	X	X	-	-	X	-	X	X	X	X
Diesel Fuel	X	X	-	-	X	-	X	X	X	X
Thiourea	X	X	-	-	X	-	X	X	X	X
Acetic Acid	-	X	-	X	X	-	X	X	X	X

Legend: X – Listed

SECTION 16 – OTHER INFORMATION

Prepared by: **Safety Health & Environment**
303-268-5000

Preparation Date: 31-Jul-2006
Revision Date: 28-April-2009

The information contained herein is offered only as guide to the handling of this specific material and has been prepared in good faith by technically knowledgeable personnel. It is not intended to be all-inclusive and the manner and conditions of use and handling may involve other and additional considerations. No warranty of any kind is given or implied and Orica will not be liable for any damages, losses, injuries or consequential damages which may result from the use of or reliance on any information contained herein.

End of MSDS